Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. XLIX. NEW YORK, JUNE 15, 1907. No. 24.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
SAN FRANCISCO OFFICE.....701 Atlas Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada..... 4.50
Other Foreign Countries within the Postal Union..... 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.
Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1905, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Entered as second-class matter at the post office at New York, N. Y.

During 1906 ELECTRICAL WORLD *printed and circulated* 970,000 *copies, an average of* 18,827 *copies per week. Of this issue* 16,000 *copies are printed.*

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THE ELECTRIC LIGHT CONVENTION.

There were many merits to the work of the National Electric Light Convention held in Washington last week, and to certain features we propose to direct attention more fully; but the comprehensive nature of the programme carried out certainly deserves notice. We doubt whether any branch of the art, engineering or commercial, was overlooked. Some of the papers may have verged too much on the abstrusely technical; others lapsed perhaps into the crudities of over-the-counter salesmanship methods; but at least the topics were dealt with. There is always an advantage in turning the soil; and the association management this time more than any tried to dig down to the roots of things. No guilty question was allowed to escape paper or discussion that could bear in any way on the welfare of the industry; and it was really amazing to find how numerous were the angles from which any topic could be viewed.

Aside from the engineering papers dealt with in detail last week or now, there were many reports and resolutions touching grave matters of policy. Just now when the public mind and conscience are aroused as to corporation affairs, the recommendations of the public policy committee were of the first importance, and much may be heard from the results presented. As a matter of fact the report would seem to commit the association broadly to the principle of automatic regulation as embodied in the "sliding scale," which allows a company to increase its dividend as it lowers its rates and improves its service. This is a very vital issue, and the plan is not yet recognized as one of general validity and application. The endorsement of the association is influential and carries weight, and its effect may be seen in later legislation. At any rate the desire of this great body to align itself with intelligent public opinion and tendencies is of the brightest augury. The action of the association in favor of a system of universal freight classification might seem more selfish in its intrinsic relationship, but the industry has suffered from an unfair incidence of rates, and is justified in taking up the matter for broader settlement.

The matter of the trade exhibit is always an important one. This year the display was admirable in practically every respect, but many of the manufacturers were not altogether happy, the chief criticisms being as to the cramped space, the exclusion of the general public, and the relatively small attendance after so much trouble and expense. Such an exhibit, it is argued, can be made both interesting to the expert and an object lesson to the public, whereas this time the spectators by the very exigencies of hotel accommodation were limited to the delegates and their immediate friends. We are glad to note that the manufacturers have now taken the matter in hand and will in future have a fuller control and guidance of the exhibit in co-operative harmony with the association. For

ourselves, we must say we like to see the exhibit made a means of missionary work with the public, and wherever this has been tried the results appear to have been gratifying.

Membership of New York Public Utilities Commissions.

The most important and varied of the duties of the recently enacted Public Utilities Commissions of New York State will undoubtedly be in relation to electric lighting and electric railway questions; and the proper disposition of these questions will necessarily involve greater or less consideration of technical matters. The granting of electrical franchises, extensions of service, increase of capitalization, analysis of expenditures, apportionment of income, investigation of lighting rates and traffic conditions—these are among the subjects which will come up that are in a greater or less degree bound up with technical considerations relating to plant and operation, which can only be properly estimated by one who is a trained electrical engineer. It is therefore most sincerely to be hoped that Governor Hughes will in the appointment of the members of the commissions find it fitting to name an electrical engineer for each body.

It may be said that the commissions could in technical matters resort to outside experts for advice; but the advice of experts merely reporting on matters of detail submitted to them would be quite different in value from the advice in arriving at final conclusions of a technical member of the board identified with its policy and responsible through the governor to the public for the proper discharge of his obligations as an officer of the state. An objection sometimes urged in favor of excluding technical men from public bodies dealing with technical matters is the alleged narrowness of their views. The suspicion that the expert could not appreciate any question beyond its purely technical significance may have had some grounds in other days; but at the present time when the successful engineer is also a man of liberal education; when larger success in his profession means capacity for the consideration not only of the technical but also of the commercial and personal factors that enter into engineering undertakings; when the administrative staffs of all electrical manufacturing and other organizations are being almost wholly recruited from the technical ranks—at this day there is no difficulty in finding plenty of engineers with the necessary breadth of view to take important part in public affairs whether technical knowledge is involved, or solely general fitness for administrative and executive work.

Two Telephone Systems.

Our report of the independent telephone convention shows activity to continue in that field in almost undiminished measure. One has long ceased to expect anything of the slightest technical value from these gatherings, and the persistent abuse heaped on the Bell system does not seem altogether good business policy, in view of the fact that the cry of "monopoly" is so hollow and that the independents are themselves rapidly crystallizing into a second close group of merged companies. In fact the air and the newspapers are full of independent telephone consolidations large and small; and the process was approved with vigor and eloquence at Chicago last week by some of the foremost leaders in the independent field. To throw several thousand companies into one physical and financial system will take time, but no man can contradict the assertion that the work is being pushed assiduously and successfully. It may take years, it may come in a very short time, but it is evidently inevitable that there will be two telephone systems —one Bell and the other "independent"—and that these will work in friendly, even if keen, rivalry, just as do the Western Union and Postal Telegraph systems to-day. And it will be a very good thing for the art, and for the public.

Fire Hazard of Electricity.

The report of the N. E. L. A. committee on the fire hazard of electricity contains much useful information for the station manager. Part of this information is statistical, and part is a condensation of expert opinions received in correspondence. In regard to the statistical information, it appears from the municipal records of New York (Manhattan and Bronx) that fires in this district are increasing in number annually at the rate of about eight per cent per annum, which is not disproportionate to the city rate of growth in population and valuation. The number of fires attributed to electrical origin does not show noticeable increase in the five years 1902-1906, for which the returns are given. At the present time there is an average of nearly one fire of some sort every hour, in Manhattan and Bronx (8063 in 1906). Of the total fires those attributed in the tables to electrical origin average 1.3 per cent, or one in 77. The average recorded loss to a fire, from any cause, during the five years, is $669. The fires attributed to gas average 7.4 per cent of the total number in five years, so that there are nearly six times as many fires attributed to gas as to electricity, but of course there is much more total illumination by gas than by electricity, in New York. The most prolific single source of fires given in the list is carelessness in the use of matches. This accounts for 10.9 per cent of the total fires, or one fire in every nine. This item includes carelessness in using matches for all purposes. A considerable share must be attributed to using matches for lighting pipes, cigars and cigarettes. In fact, seeing that every fire entails an average loss of $669, and that one-ninth of all the fires are attributed to carelessness in using matches, a small but appreciable average money risk must accompany the lighting of every match in New York City. Next to matches in order of frequency of origin in New York fires come chimneys, grates, etc.; then furnaces. Electricity comes tenth on the list. Statistics from Boston and Chicago accord fairly well with those from New York in regard to the number of fires attributed in official lists to electrical origin. Boston gives 1.95 per cent, and Chicago 1.75 per cent, of all fires as electrical.

As regards the replies received in answer to a circular letter of enquiry, about 200 replies were received from members of the N. E. L. A. in different parts of the U. S., and about 20 from fire insurance representatives. As might be expected, there is manifested a considerable difference of opinion between these two sets of replies. Nevertheless, concurrent majorities from both N. E. L. A. representatives and fire insurance representatives are reported on the following propositions: (1) There is a marked tendency on the part of the public to assign electricity as the cause of all mysterious fires. (2) The idea does not prevail that electrical installations are especially hazardous. (3) The inspection of installations of gas, gasoline, etc., is less rigid than that of electric installations. (4) The publication of quarterly reports on fires starting from

the most prolific sources would be of benefit in educating the people in general to the relative fire hazard of various agents and the best means of preventing the same. Both the representatives of the N. E. L. A. and of the fire insurance interests recommend a more strict adherence to the rules of the National Electric Code in electric installations. The committee subscribe to this recommendation in the conclusion of their report. The committee also recommend that the N. E. L. A. member companies should each appoint some individual to follow up fires in his district, in order to collect information concerning them, and to see that fires are not attributed to electrical origin without sufficient evidence. The committee's report is a valuable contribution to the subject from the station manager's point of view. It shows that increasing care should be given to electric installation in conformity with the rules of the National Electric Code, and to the education of the public in regard to the use of electricity.

STREET LIGHTING SPECIFICATIONS.

The most important matter up for consideration at the Washington N. E. L. A. Convention was the Report on Specifications for Street Lighting. There is no doubt that action on this subject had become necessary, for the resolutions of 1894 went out of date with the open arc lamp to which they had reference. At the present time there is so large a variety of street illuminants, representing so great a range of powers, colors and light distributions, that no simple wattage specification can answer the purpose of a square deal to all. Most street lighting contracts as now made are in fact not drawn upon the wattage basis save incidentally, but are really contracts for service with particular specified apparatus, the performance of which is supposed to be understood and approved by both parties. From the legal and practical standpoint such a contract if drawn and entered into under intelligent advice is simple and sound, though not based upon rigorous scientific principles. In doing public lighting there should always be a full and definite statement of the mutual obligations of the company and the city, and when this exists things generally run along smoothly. It is when vague and indeterminate phrases enter, as in the now famous Colorado Springs contract, that trouble begins.

There is no doubt that when a city enters into a contract for public lighting its ultimate object is to get suitable illumination for its streets. Unfortunately, however, illumination as a basis for a legal document is difficult properly to define, and its actual evaluation is subject to all the difficulties which inhere in the determination of the luminous intensity of its source. together with others peculiar to itself. While there is much to commend in the Atlantic City report of the Committee on Street Lighting Specifications, the practical objections to its recommendation that street lighting specifications should be based directly on illumination should be given most careful consideration before the National Electric Light Association commits itself as a body to this basis for street lighting contracts; and whatever action is taken it should be seen that the specifications are entirely free of constructions that may give rise to exasperating litigation. This latter lesson should have been learned from the Colorado Springs case, which certainly laid sufficient emphasis on the difficulties of the art of photometry, even under the most favorable conditions. In the last analysis the recommendations of the committee embody the two fundamental theses. (1) The illumination given shall be rated solely by its value near the horizontal as measured far from the source; (2) this illumination shall be measured in terms of that delivered by a standard 16-cp incandescent lamp. Incidentally, the liberty allowed in methods of measurements would appear to permit photometric difficulties to enter the reckoning in an aggravated form, especially in authorizing the use of any kind of luminometer. Such instruments at present available are far from being sufficient for the precise measurements required, since their unavoidable errors even in the hands of skilled observers may involve large sums.

It would appear that the method recommended of the rating of street lamps solely by the illumination given at the longest distance at which it is worth considering, ignores the large and valuable flux of light given at points near enough to the source to receive a really useful measure of illumination, and puts a premium on scaling down the average lighting effect. No lamp rating which fails to take some account of the total useful flux can be considered as scientifically accurate or commercially tolerable. The recommendations appear to favor particularly some of the newer types of arcs; and while those certainly have some admirable properties, especially in the matter of distribution, and while there is every reason to believe that they will be still further improved, it is questionable if the time is ripe for legislation that would precipitate another wholesale change in arc lighting and the scrapping of the large investment in apparatus now in general use. Such a change would also appear to involve the cutting of contract prices, for it is doubtful if a city would consider itself justified in holding to its present minimum illumination and giving up much of the useful light within the minimum limit, unless it received considerable advantage in rates. To advise such a change without raising a minimum illumination far above its present value appears, therefore, to be a hazardous experiment. Another serious phase of the matter is the fact that contracts on the basis of a specified minimum would play directly into the hands of the Welsbach contingent. It may be that the arc is on its last legs and that the high efficiency incandescent will soon displace it; but if a minimum of 0.01 foot-candle or some such figure between sources is good enough, look out for gas competition.

It is all very well to say, as happened in the discussion, that each company can draw its own form of contract. So long as rating by the illumination at the point where it ceases to be useful is the accepted basis, that precedent will stand as a difficulty. And so long as one falls back directly upon the 16-cp lamp as a basis or reference it strikes one as simpler to determine the distribution curve of the arc under favorable conditions than to tramp over the fields with an alleged portable instrument taking readings under the most disadvantageous circumstances. Before leaving this matter we are constrained to ask why in the name of all that is inscrutable did the association, after accepting the report of its committee, in which watt-rating is condemned, solemnly turn around and vote that "the standard carbon type of enclosed arc lamp," whatever that may be, should continue at be subject to "the power test of 450 watts at the lamp terminals," whatever that may mean.

The New York Public Utilities Law.

The Public Utilities bill which has been under so much discussion in New York, and throughout the country generally, has been passed over the veto of Mayor McClellan, of New York City, by the State Legislature and has been signed by the Governor. It becomes active almost immediately, and in view of its extraordinary interest, the time has arrived to give a synopsis of its contents, and the full details of the sections relating to electric light and power corporations. The law is an instrument of great verbosity and length, and would occupy several pages of this journal if printed in extenso.

The measure abolishes the State Railroad Commission, the State Gas and Electric Light Commission and the Rapid Transit Board of New York City and creates in their places two commissions of five members each, who shall have jurisdiction over the public service corporations of the state. The state is divided into two districts. The first district includes the entire city of Greater New York, and to it one of the commissions will devote its entire attention. The second district will comprise the rest of the state. The commissioners for both districts are to be appointed by the Governor with the consent of the Senate. He may also remove them after a trial on charges for inefficiency, neglect of duty or misconduct in office. The salary of each commissioner is fixed at $15,000 a year, the total for the ten being $150,000 annually. Each commissioner is also empowered to appoint counsel at $10,000 a year and a secretary at $6,000 a year.

The jurisdiction of the commission in the first district extends to any common carrier operating or doing business within the limits of New York City, to the manufacture and sale of gas and electricity, and in addition it shall exercise all the power of the Rapid Transit Commission conferred upon it since the passage of the act creating that body in 1891. The second district commission will have similar powers in the rest of the state, including the regulation and control of all transportation of persons and property by public service corporations. The expenses of the first district, except the salaries of the commissioners, counsel and secretary, are provided for in the same manner as the Rapid Transit Commission, and the salaries and expenses of the commission in the second district are made a charge on the state.

The term of one commissioner in each district is fixed to expire on Feb. 1, 1909, and the term of one commissioner in each district expires annually after that. Successors are appointed for full terms of five years. To the commissions is given the power to subpœna witnesses and administer oaths. Any witness who refuses to obey the subpœna or to answer the questions put to him is guilty of a misdemeanor. But any witness who testifies is immune from prosecution for any penalty or forfeiture concerning an act as to which he testifies, but this immunity does not extend to any corporation.

The utilities law prescribes the duties of the transportation companies, including the railroads, street railroads, express companies, car companies, sleeping car companies, freight companies, freight line companies, and pipe line companies and of gas and electric companies, and gives the commission power to regulate the operation of such companies.

The telephone and telegraph companies are not included within the scope of the commissions' power.

The law provides that the franchise of a public corporation shall not be transferred, assigned or leased without the permission of the commission having jurisdiction. Each commission is empowered within its jurisdiction to fix the form of accounts and reports of the public service corporations, to investigate accidents, to fix just and reasonable rates, to order adequate service as to cars, motive power, time schedules, safety devices, employees and other instrumentalities. Its orders are to be enforced until modified or abrogated by the commission or unless declared by a court of adequate jurisdiction to be unauthorized by this or any other act, or to be in contradiction of the Constitution of the United States.

Penalties ranging from $1,000 to $5,000 are imposed upon public service corporations violating the act or failing to obey any order of the commission. Shippers violating the act are also liable to a penalty. The act will take effect 30 days after it shall have become a law. Any person injured by the failure of a public service corporation to comply with an order of the commission may bring an action for damages and if successful is to be allowed to get a reasonable attorney's fee to be fixed by the Court.

Article 4 follows giving the sections and provisions relative to electrical and gas corporations and the regulation of gas and electricity prices:

Section 65. *Application of article.*—This article shall apply to the manufacture and furnishing of gas for light, heat or power and the furnishing of natural gas for light, heat or power, and the generation, furnishing and transmission of electricity for light, heat or power.

Section 66. *General powers of commissions in respect to gas and electricity.*—Each commission shall within its jurisdiction:

1. Have the general supervision of all persons and corporations having authority under any general or special law or under any charter or franchise to lay down, erect or maintain wires, pipes, conduits, ducts or other fixtures in, over or under the streets, highways and public places of any municipality, for the purpose of furnishing or distributing gas or of furnishing or transmitting electricity for light, heat or power, or maintaining underground conduits or ducts for electrical conductors.

2. Investigate and ascertain, from time to time, the quality of gas supplied by persons, corporations and municipalities; examine the methods employed by such persons, corporations and municipalities in manufacturing and supplying gas or electricity for light, heat or power, and in transmitting the same, and have power to order such improvements as will best promote the public interest, preserve the public health and protect those using such gas or electricity and those employed in the manufacture and distribution thereof, or in the maintenance and operation of the works, wires, poles, lines, conduits, ducts and systems maintained in connection therewith.

3. Have power to fix the standard of illuminating power and purity of gas, not less than that prescribed by law, to be manufactured or sold by persons, corporations or municipalities for lighting, heating or power purposes, and to prescribe methods of regulation of the electric supply system as to the use for incandescent lighting and fix the initial efficiency of incandescent lamps furnished by the persons, corporations or municipalities generating and selling electricity for lighting, and by order to require the gas so manufactured or sold to equal the standard so fixed by it, and to establish the regulations as to pressure at which gas shall be delivered. For the purpose of determining whether the gas sold by such persons, corporations or municipalities for lighting, heating or power purposes conforms to the standard of illuminating power and purity and, of its own motion, examine and investigate the methods employed in manufacturing, delivering and supplying the gas so sold, and shall have access through its members or persons employed and authorized by it to make such examinations and investigations to all parts of the manufacturing plants owned, used or operated for the manufacture or distribution of gas by any such person, corporation or municipality. Any employee or agent of the commission who divulges any fact or information which may come to his knowledge during the course of any such inspection or examination, except in so far as he may be directed by the commission, or by a court or judge thereof, or authorized by law, shall be guilty of a misdemeanor.

4. Have power, in its discretion, to prescribe uniform methods of keeping accounts, records and books, to be observed by the persons, corporations and municipalities engaged in the manufacture, sale and distribution of gas and electricity for light, heat or power.

5. Examine all persons, corporations and municipalities under its supervision, keep informed as to the methods employed by them in the transaction of their business and see that their property is maintained and operated for the security and accommo-

dation of the public and in compliance with the provisions of law and of their franchises and charters.

6. Require every person and corporation under its supervision to submit to it an annual report, verified by the oath of the president, treasurer, or general manager thereof, showing in detail (1) the amount of its authorized capital stock and the amount thereof issued and outstanding; (2) the amount of its authorized bonded indebtedness and the amount of its bonds and other forms of evidence of indebtedness issued and outstanding; (3) its receipts and expenditures during the preceding year; (4) the amount paid as dividends upon its stock and as interest upon its bonds; (5) the name of, and the amount paid as salary to each officer and the amount paid as wages to its employees; (6) the location of its plant or plants and system, with a full description of its property and franchises, stating in detail how each franchise stated to be owned was acquired, and (7) such other facts pertaining to the operation and maintenance of the plant and system, and the affairs of such person or corporation as may be required by the commission. Such report shall be in the form, cover the period and be submitted at the time prescribed by the commission. The commission may, from time to time, make changes and additions in such forms, giving to the persons, corporations and municipalities six months' notice before the time fixed by the commission as the expiration of the fiscal year of any changes or additions which would require any alteration in the method or form of keeping their accounts for the ensuing year. When any such report is defective or believed to be erroneous, the commission shall notify the person, corporation or municipality making such report to amend the same within thirty days. Any such person or corporation or municipality which shall neglect to make any such report within the time specified by the commission, or which shall fail to correct any such report within thirty days after notice, shall be liable to a penalty of $100, and an additional penalty of $100 for each day after the prescribed time for which it shall neglect to file or correct the same, to be sued for in the name of the people of the state of New York. The amount recovered in any such action shall be paid into the state treasury and be credited to the general fund. The commission may extend the time herein limited for cause shown.

7. Require each municipality engaged in operating any works or systems for the manufacture and supplying of gas or electricity to make an annual report to the commission, verified by the oath of the general manager or superintendent thereof, showing in detail, (1) the amount of its authorized bonded indebtedness and the amount of its bonds and other forms of evidence of indebtedness issued and outstanding for lighting purposes, (2) its receipts and expenditures during the preceding year, (3) the amount paid as interest upon its bonds and upon other forms of evidence of indebtedness, (4) the name of and the amount paid to each person receiving a yearly or monthly salary, and the amount paid as wages to employees, (5) the location of its plant and system with a full description of the property, and (6) such other facts pertaining to the operation and maintenance of the plant and system, as may be required by the commission. Such report shall be in the form, cover the period and be submitted at the time prescribed by the commission.

8. Have power, either through its members or inspectors or employees duly authorized by it, to enter in or upon and to inspect the property, buildings, plants, factories, power houses and offices of any such corporations, persons or municipalities.

9. Have power to examine the books and affairs of any such corporation, persons, or municipalities, and to compel the production before it of books and papers pertaining to the affairs being investigated by it.

10. Have power, either as a commission or through its members to subpœna witnesses, take testimony and administer oaths to witnesses in any proceeding or examination instituted before it, or conducted by it in reference to any matter within its jurisdiction under this article.

Section 67. *Inspection of gas and electric meters.*—1. Each commission shall appoint inspectors of gas and electric meters whose duty it shall be when required, to inspect, examine, prove and ascertain the accuracy of any and all gas meters used or intended to be used for measuring or ascertaining the quantity of illuminating or fuel gas or natural gas furnished by any gas corporation to or for the use of any person and any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electricity furnished for light, heat and power by any electrical corporation to or for the use of any person or persons and when found to be or made to be correct, the inspector shall stamp or mark all such meters and each of them with some suitable device, which device shall be recorded in the office of the secretary of state.

2. No corporation or person shall furnish or put in use any gas meter which shall not have been inspected, proved and sealed, or any electric meter which shall not have been inspected, approved, stamped or marked by an inspector of the commission. Every gas and electrical corporation shall provide or keep in and upon its premises a suitable and proper apparatus to be approved and stamped or marked by the commission, for testing and proving the accuracy of gas and electric meters furnished for use by it, and by which apparatus every meter may and shall be tested, on the written request of the consumer to whom the same shall be furnished, and in his presence if he desires it.

If any consumer to whom a meter has been furnished, shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same on being so tested shall be found to be 4 per cent if an electric meter, or 2 per cent if a gas meter, defective or incorrect to the prejudice of the consumer, the inspector shall order the the gas or electrical corporation forthwith to remove the same and to place instead thereof a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same on being so tested shall be found to be correct the expense of such inspection and test shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service.

Section 68. *Approval of incorporation and franchises; certificate.*—No gas corporation or electrical corporation incorporated under the laws of this or any other state shall begin construction, or exercise any right or privilege under any franchise hereafter granted, or under any franchise heretofore granted but not heretofore actually exercised without first having obtained the permission and approval of the proper commission. Before such certificate shall be issued a certified copy of the charter of such corporation shall be filed in the office of the commission, together with a verified statement of the president and secretary of the corporation, showing that it has received the required consent of the proper municipal authorities. No munipality shall build, maintain and operate for other than municipal purposes any works or systems for the manufacture and supplying of gas or electricity for lighting purposes without a certificate of authority granted by the commission. If the certificate of authority is refused, no further proceedings shall be taken before the commission, but a new application may be made therefor after one year from the date of such refusal.

Section 69. *Approval of issues of stock, bonds and other forms of indebtedness.*—A gas corporation or electrical corporation organized or existing, or hereafter incorporated, under or by virtue of the laws of the state of New York, may issue stocks, bonds, notes or other evidence of indebtedness payable at periods of more than 12 months after the date thereof, when necessary for the acquisition of property, the construction, completion, extension or improvement of its plant or distributing system, or for the improvement or maintenance of its service or for the discharge or lawful refunding of its obligations, provided and not otherwise that there shall have been secured from the proper commission an order authorizing such issue, and the amount thereof, and stating that, in the opinion of the commission, the use of the capital to be secured by the issue of such stock, bonds, notes or other evidences of indebtedness is reasonably required for the said purposes of the corporation. For the purpose of enabling it to determine whether or not it should

issue such an order, the commission shall make such inquiry or investigation, hold such hearings and examine such witnesses, books, papers, documents or contracts as it may deem of importance in enabling it to reach a determination. Such gas corporation or electrical corporation may issue notes, for proper corporate purposes and not in violation of any provision of this or any other act, payable at periods of not more than 12 months without such consent; but no such notes shall, in the whole or in part, directly or indirectly be refunded by any issue of stock or bonds or by any evidence of indebtedness running for more than 12 months without the consent of the proper commission. Provided, however, that the commission shall have no power to authorize the capitalization of any franchise to be a corporation or to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount (exclusive of any tax or annual charge) actually paid to the state or to any political subdivision thereof as the consideration for the grant of such franchise or right. Nor shall the capital stock of a corporation formed by the merger or consolidation of two or more other corporations, exceed the sum of the capital stock of the corporations, so consolidated, at the par value thereof, or such sum and any additional sum actually paid in cash; nor shall any contract for consolidation or lease be capitalized in the stock of any corporation whatever; nor shall any corporation hereafter issue any bonds against or as a lien upon any contract for consolidation or merger.

Section 70. *Approval of transfer of franchise.*—No gas corporation or electrical corporation shall transfer or lease its franchise, works or system or any part of such franchise, works or system to any other person or corporation or contract for the operation of its works and system, without the written consent of the proper commission. The permission and approval of the commission, to the exercise of a franchise under section 68 of this act, or to the assignment, transfer or lease of a franchise under this section shall not be construed to revive or validate any lapsed or invalid franchise or to enlarge or add to the powers and privileges contained in the grant of any franchise or to waive any forfeiture. No such corporation shall directly or indirectly acquire the stock or bonds of any other corporation incorporated for, or engaged in, the same or a similar business, or proposing to operate or operating under a franchise from the same or any other municipality, unless authorized so to do by the commission. Save where stock shall be transferred or held for the purpose of collateral security only with the consent of the commission empowered by this act to give such consent, no stock corporation of any description, domestic or foreign, other than a gas or electrical corporation, shall purchase or acquire, take or hold, more than 10 per centum of the total capital stock issued by any gas corporation or electrical corporation organized or existing under or by virtue of the laws of this state. Nothing herein contained shall be construed to prevent the holding of stock heretofore lawfully acquired. Every contract, assignment, transfer or agreement for transfer of any stock by or through any person or corporation to any corporation, in violation of any provision of this act, shall be void and of no effect, and no such transfer or assignment shall be made upon the books of any such gas corporation, or electrical corporation, or shall be recognized as effective for any purpose.

Section 71. *Complaints as to quality and price of gas and electricity; investigation by commission; forms of complaints.*—Upon the complaint in writing of the mayor of a city, the trustees of a village or the town board of a town in which a person or corporation is authorized to manufacture, sell or supply gas or electricity for heat, light or power, or upon the complaint in writing of not less than 100 customers or purchasers of such gas or electricity in cities of the first or second class, or of not less than 50 in cities of the third class, or of not less than 25 elsewhere, either as to the illuminating power, purity, pressure or price of gas or the initial efficiency of the electric incandescent lamp supply, or the regulation of the voltage of the supply system used for incandescent lighting, or price of electricity sold and delivered in such municipality, the proper commission shall investigate as to the cause for such complaint. When such complaint is made, the commission may, by its agents, examiners and inspectors, inspect the works, system, plant and methods used by such person or corporation in manufacturing, transmitting and supplying of such gas or electricity, and may examine or cause to be examined the books and papers of such person or corporation pertaining to the manufacture, sale and transmitting and supplying of such gas or electricity. The form and contents of complaints made as provided in this section shall be prescribed by the commission. Such complaints shall be signed by the officers or by the customers, purchasers or subscribers making them, who must add to their signatures their place of residence, by street and number, if any.

Section 72. *Notice and hearing; order fixing price of gas or electricity, or requiring improvement.*—Before proceeding under a complaint presented as provided in section 71, the commission shall cause notice of such complaint, and the purpose thereof, to be served upon the person or corporation affected thereby. Such person or corporation shall have an opportunity to be heard in respect to the matter complained of at a time and place to be specified in such notice. If an investigation be instituted upon motion of the commission the person or corporation affected by the investigation may be permitted to appear before the commission at a time and place specified in the notice and answer all charges which may be preferred by the commission. After a hearing and after such investigation as may have been made by the commission or its officers, agents, examiners or inspectors, the commission within lawful limits may, by order, fix the maximum price of gas or electricity to be charged by such corporation or person, or may order such improvement in the manufacture or supply of such gas, in the manufacture, transmission or supply of such electricity, or in the methods employed by such person or corporation, as will in its judgment improve the service. The price so fixed by the commission shall be the maximum price to be charged by such person or corporation for gas or electricity in such municipality until the commission shall upon complaint as provided in this section or upon investigation conducted by it on its own motion, again fix the maximum price of such gas or electricity. In determining the price to be charged for gas or electricity the commission may consider all facts which in its judgment have any bearing upon a proper determination of the question, although not set forth in the complaint and not within the allegations contained therein.

Section 73. *Forfeiture for non-compliance with order.*—Every gas corporation and electrical corporation and the officers, agents or employees thereof shall obey, observe and comply with every order made by the commission under authority of this act, so long as the same shall be and remain in force. Any such corporation, or any officer, agent or employee thereof, who knowingly fails or neglects to obey or comply with such order, or any provision of this act, shall forfeit to the state of New York not to exceed the sum of one thousand dollars for each offense. Every distinct violation of any such order or of this act, shall be a separate offense, and in case of a continuing violation each day shall be deemed a separate offense. An action to recover such forfeiture may be brought in any court of competent jurisdiction in this state in the name of the people of the state of New York, and shall be commenced and prosecuted to final judgment by counsel to the commission. In any such action all penalties and forfeitures incurred up to the time of commencement, the same may be sued for and recovered therein and the commencement of an action to recover a penalty or forfeiture shall not be, or be held to be, a waiver of the right to recover any other penalty or forfeiture; if the defendant in such action shall prove that during any portion of the time for which it is sought to recover penalties or forfeitures for a violation of an order of the commission the defendant was actually and in good faith prosecuting the suit, action or proceeding in the court to set aside such order, the court shall remit the penalties or forfeitures incurred during the pendency of such suit, action or proceeding. All moneys recovered in any such action,

together with the costs thereof, shall be paid into the state treasury to the credit of the general fund.

Section 74. *Summary proceedings.*—Whenever either commission shall be of opinion that a gas corporation, electrical corporation or municipality within its jurisdiction is failing or omitting or about to fail or omit to do anything required of it by law or by order of the commission or is doing anything or about to do anything or permitting anything or about to permit anything to be done, contrary to or in violation of law or of any order of the commission, it shall direct counsel to the commission to commence an action or proceeding in the Supreme Court of the state of New York in the name of the commission for the purpose of having such violations or threatened violations stopped and prevented either by mandamus or injunction. Counsel to the commission shall thereupon begin such action or proceeding by petition to the supreme court alleging the violation complained of and praying for appropriate relief by way of mandamus or injunction. It shall thereupon be the duty of the court to specify the time not exceeding 20 days after service of a copy of the petition within which the gas corporation, electrical corporation or municipality complained of must answer the petition. In case of default in answer or after answer, the court shall immediately inquire into the facts and circumstances in such manner as the court shall direct without other or former pleadings, and without respect to any technical requirement. Such other persons or corporations, as it shall seem to the court necessary or proper to join as parties in order to make its order, judgment or writs effective, may be joined as parties upon application of counsel to the commission. The final judgment in any such action or proceeding shall either dismiss the action or proceeding or direct that a writ of mandamus or an injunction or both issue as prayed for in the petition or in such modified or other form as the court may determine will afford appropriate relief.

Section 75. *Defense in case of excessive charges for gas or electricity.*—If it be alleged and established in an action brought in any court for the collection of any charge for gas or electricity, that a price has been demanded in excess of that fixed by the commission or by statute in the municipality wherein the action arose, no recovery shall be had therein, but the fact that such excessive charges have been made shall be a complete defense to such action.

Section 76. *Jurisdiction.*—Whenever any corporation supplies gas or electricity to consumers in both districts, any application or report to a commission required by this act shall be made to the commission of the district within which it is mainly supplying, or proposing to supply, such service to consumers. But nothing herein contained shall be construed to deprive the commission of either district of the power of supervision and regulation within its district. And either commission shall have power to enter and inspect the plant of such corporation, wherever situated.

Section 77. *Powers of local officers.*—If in any city of the first or second class there now exists or shall hereafter be created a board, body or officer having jurisdiction of matters pertaining to gas or electric service, such board, body or officer shall have and may exercise such powers, jurisdiction and authority in enforcing the laws of the state and the orders, rules and regulations of the commission as may be prescribed by statute or by the commission.

Mr. Dudley Farrand, President National Electric Light Association.

Mr. Dudley Farrand, the new president of the National Electric Light Association, is general manager of the electrical department of the Public Service Corporation of New Jersey. Mr. Farrand has always lived in the neighborhood of the present scene of his activity at Newark. He was born and brought up in Essex County, New Jersey, and after graduation from the Newark Academy, attended Princeton University for a time, but on account of poor health did not finish the course. Twenty-one years ago he entered the employ of the Newark Electric Light & Power Company. This at that time was a very small organization having a connected load of 150 arc lamps and 365 incandescents. His position was that of general assistant in the office. The company expanded, and in 1889 and 1890 took in two other companies operating in Newark. These two other companies in due course of time and after many changes became a part of the Public Service Corporation

PRES. DUDLEY FARRAND.

of New Jersey, which includes some 40 companies and operates various public utilities in 140 towns. Mr. Farrand's advancement has kept pace with the growth of the companies with which he has been connected all of his business life. As general manager of the Electrical Department he has supervision of the design, construction and operation of all the stations and substations of the system, which includes 27 generating stations and 30 sub-stations. He is one of the youngest of the recent presidents of the National Electric Light Association, being slightly less than forty years of age.

CURRENT NEWS AND NOTES.

CHINESE LIGHTING.—The charter for an electric light company with 200,000 taels (Kirin tael about 75 cents) in Kirin, Manchuria, has been obtained by a German merchant, who is nominally represented by a Chinaman.

POST OFFICE TELEPHONES.—The independent telephone men of Indiana propose making a strong effort to bring about the annulment of the order of the United States Government forbidding postmasters to put telephones in their offices unless the instruments have direct connection with Washington. The order is declared to be unfair to the capital invested in independent telephone property and to the 3,000,000 subscribers and patrons of the independent companies.

NEW YORK ELECTRICAL SOCIETY.—At the annual meeting of the New York Electrical Society, held June 10, the following-named officers were elected: President, Prof. Albert F. Ganz, of Stevens Institute of Technology; vice-presidents, Augusuts Post, Theodore Beran and W. L. Conwell; secretary, George H. Guy; treasurer, H. A. Sinclair. The society now has a membership list of 831. After the election, Dr. William H. Tolman, director of the American Museum of Safety Devices and Industrial Hygiene, delivered an interesting lecture on "Safety and Security for American Life and Labor," illustrated with lantern slides. The society elected 194 members during the season.

TWO CENT FARES.—Governor Hughes has vetoed the Baldwin two cent fare bill passed by the New York Legislature, saying that what it aims at is provided by the Public Utilities law, and that the bill represents a policy seriously mistaken and fraught with danger.

THE TELEGRAPHERS' STRIKE.—According to newspaper reports the telegraphers' union is making elaborate preparations for the strike if it should become necessary to inaugurate it. The reports, however, are all one-sided. The company has nothing to say regarding the situation.

TRADE SCHOOL CONVENTION.—The trade school convention to be held in Indianapolis this week will be the first of the kind ever held. The convention will be open to the public, the committee having invited all employers of workmen to hear the speakers, among whom will be James A. Emery, of New York, secretary of the Citizens' Industrial Association of America; George H. Ellis, of Boston; James W. Vancleve, of St. Louis, and Dr. Frank Gunsaulus, president of the Armour Institute of Chicago.

THE REJUVENATED SONS OF JOVE had anticipated holding a rejuvenation at the time of the National Electric Light Convention in Washington, but owing to the very full programme provided it was found impossible to do so without interfering with the meetings of the association. Another consideration which led them to postpone the rejuvenation was that so many of the members of the order and the candidates for initiation had their wives with them and it would have taken the gentlemen from the ladies for an entire evening. It was therefore decided to postpone the rejuvenation until the time of the National Electrical Contractors' Association convention in New York in July, at which time there is likely to be a very long list of candidates for initiation.

LAKE CHAMPLAIN CONVENTION.—The Street Railway Association of the State of New York will hold its twenty-fifth annual convention at Hotel Champlain, Lake Champlain, New York, on June 25 and 26, when an interesting programme of papers will be presented, including one on "Power," by Mr. S. B. Storer, of the Niagara, Lockport & Ontario Power Company. On June 27, the convention will be followed by a meeting of the Empire State Gas & Electric Association, when the two bodies will merge, in a sense, for a discussion of the various important features of the new Public Utilities law and the methods to be adopted by lighting, traction companies, etc., in conforming with its provisions. Altogether this will make a most interesting week and it is expected that there will be a large attendance.

MISSISSIPPI WATER POWER AT MINNEAPOLIS.—The United States Government will soon complete a couple of dams in the Mississippi River between Minneapolis and St. Paul to be maintained for navigation purposes. In order to relieve the government of the expense of maintaining these dams, it has been proposed to lease water power rights to some private company, the development of the water power to be done by the company. The last Congress provided for the appointment of a commission to investigate the water power situation, and this commission will soon make an investigation. The commission consists of Major W. V. Judson, United States Engineer, War Department; Captain Amos W. Kimball, quartermaster, Fort Snelling, and Mr. J. E. Woodwell, chief inspector of electric plants of the Treasury Department; Mr. Woodwell being the electrical engineering member of the commission. The head available between the two cities is about 35 ft. One interesting feature of the situation is the possibility of pumping up water to elevated reservoirs by means of centrifugal pumps during light loads, this water to be discharged through impulse wheels at high head to carry peak loads.

MUNICIPAL OWNERSHIP REPORT.—The final work has been done this week on the report of the municipal ownership commission of the National Civic Federation, the committee on investigation having held protracted sessions at the Knickerbocker Hotel. The work of the experts, economists, publicists and accountants, who have been engaged on the matter for 18 months, will now be issued in book form, and will be issued in two parts under the title "The Facts of Municipal Ownership," embodying data on 29 public and private plants in America and 24 in Great Britain. Volume I will embrace the general conclusions of the commission—about 500 pages—including valuable special reports. Part Two includes volumes two and three, the first devoted to American reports and the second to those on Great Britain and Ireland. Orders for these can be sent to Mr. E. A. Moffett, secretary, 281 Fourth Avenue, New York, the price being $2 for Part One and $8 for Part Two, checks being payable to Mr. Isaac N. Seligman, treasurer. It is advisable to order this valuable set promptly as the edition will be limited. The analytical character of the work of this investigation only a study of the full report of the commission can indicate. Some idea of the scientific methods employed may be had from the fact that schedules of questions prepared by noted engineers and economists were followed in the case of each plant and system examined. These schedules disposed the questions under several general heads, as follows: (*a*) Historical and General; (*b*) Supervision of Municipalities; (*c*) Public Supervision of Private Companies; (*d*) Franchises of Private Companies; (*e*) Organization; (*f*) Political Conditions; (*g*) Labor; (*h*) Character of Service and Plant; (*i*) Financial Matters; (*j*) Capital Stock and Bonds; (*k*) Assets; (*l*) Liabilities; (*m*) Receipts; (*n*) Expenses; (*o*) Profit and Loss. The public utilities considered are gas, water, electric light and power, and street railways.

ACCIDENT LIABILITY.—In an address at the Jamestown Exposition on Monday, June 10, President Roosevelt spoke strongly in favor of the safety appliance law and an extension of its terms as to compensation. "The present practice is based on the view announced nearly seventy years ago, that 'principles of justice and good sense demand that a workman shall take upon himself all the ordinary risks of his occupation.' In my view, principles of justice and good sense demand the very reverse of this view, which experience has proved to be unsound and productive of widespread suffering. It is neither just, expedient, nor humane; it is revolting to judgment and sentiment alike, that the financial burden of accidents occurring because of the necessary exigencies of their daily occupation should be thrust upon those sufferers who are least able to bear it, and that such remedy as is theirs should only be obtained by litigation which now burdens our courts. As a matter of fact, there is no sound economic reason for distinction between accidents caused by negligence and those which are unavoidable, and the law should be such that the payment of those accidents will become automatic instead of being a matter of lawsuit. Workmen should receive a certain definite and limited compensation for all accidents in industry, irrespective of negligence. When the employer, the agent of the public, on his own responsibility and for his own profit, in the business of serving the public, starts in motion agencies which create risks for others, he should take all the ordinary and extraordinary risks involved, and, though the burden will at the moment be his, it will ultimately be assumed, as it ought to be, by the general public. Only in this way can the shock of the accident be diffused, for it will be transferred from employer to consumer, for whose benefit all industries are carried on. From every standpoint the change would be a benefit. The community at large should share the burden as well as the benefits of industry. Employers would thereby gain a desirable certainty of obligation and get rid of litigation to determine it. The workman and the workman's family would be relieved from a crushing load."

STILL STRIKING.—The Telegraphers' Union is still striking but has not yet struck. The forces of the Western Union and Postal Telegraph systems remain intact, but the national executive committee is to meet this week in New York, and then something may happen.

ELECTRICAL TRADE CONVENTION.—The eighth annual meeting of the National Electrical Trade Association will be held at the Grand Pacific Hotel, Chicago, on June 20, at 2 p. m. The various co-operative credit protection bodies in the electrical industry will be represented, and a good attendance is expected.

WESTERN UNION IN WYOMING.—At Cheyenne, Wyo., on May 29, ouster proceedings were filed in the district court by Attorney General Mullan against the Western Union Telegraph Company because of its failure to file its articles of incorporation in Wyoming. The company bases its refusal on the ground that it is carrying on interstate business, and its establishment in Wyoming preceded the enactment of the law.

NEW YORK TELEPHONE FRANCHISES.—In connection with the attempts to develop "independent" telephony in New York City, and in a report submitted to the Board of Estimate and Apportionment, Corporation Counsel Ellison has expressed his opinion that the city cannot grant a perpetual monopoly of the telephone service in the city streets. If it appears best that there should be only one telephone service in the city, the Board of Estimate may make a grant for such a service, but such a grant should not be a bar to the subsequent making of grants to other parties under changed conditions for similar service.

TELEGRAPHY IN BELGIUM.—According to some statistics of the Belgium state telegraph department recently published, 77 per cent of Belgian telegrams sent are received at the office of destination from one to fifteen minutes after being filed at the sending office. Of a total of 3,589,126 domestic telegrams, 35,612 were filed and sent as "urgent," for which service an extra charge is made. The largest class of messages were those of from 11 to 15 words (56.82 per cent), the average of all messages being 15.79 words. Telegrams to and from foreign countries numbered 3,203,482, being nearly equal in number to telegrams between offices in Belgium. The total of messages exchanged with all American countries was 111,245. Of European countries France ranks highest with 811,102 messages, Germany second with 796,284 and Great Britain third with 544,537. The close commercial relations between Belgium and Russia is indicated by the latter ranking fifth on the list, Holland being fourth.

NEW YORK TELEPHONY.—A special dispatch from Washington of June 8 gives the following interview, which is not without picturesque interest: "John C. Sheehan, of New York, at the New Willard Hotel to-night said that he represented practically all of the independent telephone companies of New York State and some few outside, and that these companies were in the course of being incorporated into one great concern, which would enter the field in opposition to the Bell company, with the view of also entering New York City. He said that his trip here was in connection with this consolidation, and that, though practically completed, there had been no intention of announcing the position of the company until a later date. 'Many telephone companies,' said Mr. Sheehan, 'have endeavored to get into New York City, and have failed. Nevertheless, we feel confident that our position is such that we have the right to the streets and that we may lay telephone wires as well as power wires. No other power or lighting company has been able to gain entrance. Their positions were the same as that of the telephone people. Yet the courts have decided that we have the perpetual franchise, and that our wires may pass through the subways and conduits, which are nothing more than common carriers. The ruling, we hold, applies to telephone wires as well. There are a great many independent telephone companies in the State. They will all enter our combination, and there are already a number of companies outside the State which are listed, notably in New Jersey. For the present we will center our forces about New York.'"

ILLITERATE ENGINEERS.—The College of Engineering of the University of Illinois has recently established a regulation that all freshmen and sophomore engineering students shall do a prescribed amount of non-professional reading the first and second summer vacations. This has been done because the engineering courses are made up almost wholly of technical subjects; and therefore the students are likely to overlook the importance of an acquaintance with literature, history and general science. Twenty-five or thirty years ago it was not generally considered essential for an engineer to have a college education; but it is now recognized by nearly every one that no one can hope for any considerable success as an engineer who is not a graduate of an engineering college. But nowadays it is necessary that the trained engineer must have a broader training than can be offered him in the four years of his technical course. To supply this broader training to as large an extent as possible without adding to the time which the Illinois University student must give to his college course, the scheme of required summer reading has been adopted. The books to be read must be selected from the lists given in a pamphlet recently issued by the college, including standard works in history, fiction, poetry and science, selected for their value from the point of view of general training, and at the same time for their attractiveness and interest. Each student must report in the fall on books aggregating credit for one hundred points. The books vary in credit, yielding from five points for Tyndall's Faraday as a Discoverer to fifty points for Motley's Rise of the Dutch Republic. To the required lists are added a long supplementary list of desirable books which the students will find profitable and desirable reading. This supplementary list includes fiction, history, biographies of statesmen and men of science, works on politics, engineers and engineering, arts and artists.

THE ELECTRIC PSYCHOMETER.—This instrument of Dr. C. G. Jung is said to carry the study of mental conditions further than has hitherto been possible. "Two electrodes are placed in the hands of the suspected criminal or the mental pervert who is the subject of investigation. This brings him into electric contact with the psychometer. As a result of the law discovered by Tarchanoff, the electric current passing through his body is modified by any abnormal physical or nervous activity which is produced in the latter through the stress of emotion. This modification of the current is registered by means of a mirror and a moving ray of light upon a glass scale, from which it is transferred by an automatic pencil to a moving cylinder carrying a sheet of paper. The line traced by this pencil is thus an accurate reproduction of the waves which are produced in the current in its passage through the subject's body. With the electrodes in his hands the man is given hundreds of test words to answer. Most of these words, probably, do not excite any emotion in him. In that case the electric current is not deflected, the ray of light is not agitated, and the line traced on the revolving cylinder is straight and even. But among the test words comes one that carries with it an association of ideas that vividly calls to mind something connected with the crime, we will say, which the man is endeavoring to conceal. Outwardly he is able to regard his questioner with calmness, and to give the response-word without a quiver in his voice. But there is an acceleration or diminution in the flow of blood in his veins. Ordinarily invisible, it is this inner, untrollable manifestion which impresses itself upon the electric current that is passing through him, the effect of which is quickly shown, to those who are watching the experiment, in the sudden agitation of the moving ray of light and in the irregular, jagged line—the record, it may be, of the man's guilt—which is rapidly traced on the revolving cylinder."

NEW GERMAN CABLE.—King Alfonso of Spain has signed the decree authorizing the new German transatlantic cable from Emden to New York to touch at Teneriffe, Canary Islands.

RAILROAD TELEGRAPHERS.—It is stated that the railroads in both the South and West are anxious to employ 10,000 extra telegraph operators. The wages run from $55 to $100 a month. On the first of next January, the law which limits the hours of railroad telegraphers to nine hours goes into effect and will further increase the demand.

CALCUTTA CITY LIGHTING.—The Municipal Council of Calcutta, India, invites proposals until December 31 for the lighting of the town by either electricity, gas, oil or any other method. Area, 20 square miles; 300 miles of streets, including 170 miles of main streets, all lighted at present by about 9300 gas lamps of an equivalent of 11,300 24-cp lamps and 2400 24-cp oil lamps.

AGAINST BUCKET SHOPS.—Governor Stuart, of Pennsylvania, has signed the anti-bucket shop bill. The law goes into effect immediately and fixes a penalty of from $25 to $100 and six months' imprisonment for proprietors of bucket shops convicted of a first offence, and from sixty days to six months' imprisonment for the second offence. It also prescribes penalties for telegraph and telephone companies who furnish bucket shops with quotations and also for the owners of buildings who permit these shops to do business on their premises.

TELEPHONY IN TURKEY.—United States Consul-General G. B. Ravndal writes as follows from Beirut, Syria: Electricity being no longer prohibited in Turkey, it is likely that concessions for the introduction of telephones soon will be applied for and granted in the case of the larger cities. There are no telephones as yet in the Ottoman Empire, while in Egypt there are 4243 subscribers (1924 in Alexandria; Cairo, 1708; Port Said, 177; Tantah, 112; Suez, 88). Applicants for franchises should address themselves in person or by proxy to the Public Works Department in Constantinople, Turkey.

KINEMATOGRAPH HARMFUL.—In America recently objections have been made to moving picture and phonograph halls on account of their tendency to promote immorality. In Germany, the police of Berlin are making war against kinematograph exhibits. Physicians have shown that they are injurious to the eyes. It is declared that the quivering movements of the films are most harmful, particularly to the eyes of children. At present there are 200 kinematograph theaters in Berlin and the suburbs, and these shows seem to be as popular abroad as here, with the same lighting effects and spectacular display.

OCEAN WIRELESS.—A special dispatch from Berlin of May 30 says: "With the hope of surpassing the records made recently of keeping Atlantic liners in continuous telegraphic communication with land stations, the German Wireless Telegraphic Company will begin next week a series of important experiments. The wireless station at Nauen, which heretofore has sent messages 1500 miles, is to be enlarged and equipped with improved apparatus. As a result of preliminary experiments, the managers now expect to reach ships 2500 miles distant, and send messages with sufficient clearness and certainty to insure the practicability of the system for ordinary commercial use."

A UNIVERSAL DIRECTORY.—The 1907 edition of the Universal Electrical Directory, issued by H. Alabaster, Gatehouse & Company, of London, contains no fewer than 32,883 names in its four sections, British, Colonial, Continental and American. Each section is sub-divided into an alphabetical and classified section, and in the case of the British a Geographical Section has been added, which is of unquestioned use to travelers. A thumb index simplifies the turning up of any part desired. The alphabetical sections include telegraphic addresses and telephone numbers and codes and many financial particulars regarding British limited liability companies. Lists of all electricity undertakings in the United Kingdom and colonies are given, showing the nature of the supply, system of distribution, capacity of plant, voltage and chief engineer's name, and in the case of alternating current the phase and periodicity also appear.

TELEPHONY IN CHICAGO.—Advices from Chicago state that the ordinance which has been drafted by the City Council extending the franchise of the Chicago Telephone Company 20 years contains clauses providing that the company's books shall be opened to city inspection at any time; the city to be paid 3 per cent of gross receipts in Chicago; to have free telephone service in the City Hall and a discount of 25 per cent on all other city business. The maximum rates are fixed throughout the city limits; business lines $15 per quarter, with a maximum of 300 calls; and the rates at all private exchanges will be substantially reduced. Trunk line charges are reduced from $36 to $24 per annum, and where messages are contracted for in advance there will be no charge for trunk lines. It will be possible under the new ordinance to obtain business calls at 2.8 cents each. Residence rates will be greatly reduced, and public telephone calls will be fixed at 5 cents. The city reserves the right to regulate any of the rates of the company at periods of five years, and further provides that if the telephone company shall make net earnings in excess of 10 per cent on the money actually invested in the plant, such excess earnings shall be paid to the city. The company must also set aside not less than 4 per cent, nor more than 8 per cent, upon the amount invested for a depreciation fund. The city may purchase the plant if it so desires in 1919, or in 1924, or at the termination of the ordinance, paying the cost of duplication less depreciation, with 5 per cent in addition as compensation for the compulsory sale, without taking into account earning power or value of franchises. It may be doubted whether any city will ever buy a large telephone system. Such municipal plants have inevitably failed in Europe.

SEVERE SUBMARINE BOAT TESTS.—In addition to the various tests already made, a further series of trials has been laid down for the *Octopus, Cuttlefish, Tarantula* and *Viper* to be made off Point Judith, beginning this month, and upon which is contingent their acceptance by the Government. It is called a sea trial, and it is required that the vessels go out in the open water and remain there four days, during which they must be entirely self-supporting. During the first twenty-four hours six of these must be spent entirely submerged and under way, while for the remaining eighteen hours the boats must be run at full speed on the surface, and during part of the time they must charge their batteries. Details of the other tests upon which are contingent the trial acceptance by the Government, for which they were built, follow: First—Standardization, in light condition, gasoline engines only being used; in the awash condition electric power only being used, and submerged using electric motors only. During these tests the speed of the boats in the several conditions will be determined. The propellers will also be standardized while batteries are being charged under way. Second—A four-hour endurance trial, in a light condition, under full speed, to note the consumption of fuel, from which the radius of action of the boats will be determined. Third—One hour's run, submerged, during which a torpedo shall be fired from each tube at a target. Fourth—Three hours' trial awash and submerged, at full speed, in order to see if the battery has the capacity to give the guaranteed endurance submerged. Fifth—Quick diving or submergence test, the vessels to be brought as rapidly as possible from full speed on the surface under the engines to full speed submerged under the motors. Sixth—Each boat shall fire all her torpedoes submerged at a target and reload while turning under water. Seventh—Discharging the batteries at a low rate to determine the radius of action of the boat under water. Eighth—Manœuvring trials. Turning trials, reversing and submerging when not under way.

Coal Handling and Condensing Equipment in the Gold Street Station of the Edison Electric Illuminating Company of Brooklyn.

CENTRAL station practice has undergone such extensive and radical changes in the last few years that many plants constructed less than a decade ago have become obsolete. One of the most potent factors in bringing about this development has been the advent of the steam turbine as a prime mover. Changes have been especially noticeable in the larger cities where the value of real estate makes it necessary to utilize every square foot of ground to the best advantage, and where the steam turbine unit, taking up so much less floor space for the same output, has made it possible to generate 50 per cent more power with the same investment as for engine driven units. This has been found so advantageous that in several of the larger central stations the original plan of a certain number of engine driven units has been altered before the full complement had been installed, turbo-generators of largely increased capacity being substituted for the reciprocating type when additions were made.

In 1905 the engineers of the Edison Electric Illuminating Company of Brooklyn were confronted with a situation calling for a decision as to means of increasing the generating capacity of their system quickly and with the least disturbance to operating conditions. As the company's property at Gold Street was sufficiently extensive to offer a ready field for both present needs and future requirements, and as the location was much nearer the center of distribution of the system than the plant at Sixty-Sixth Street, the Gold Street station was selected for the development of a plan making it the main generating station of the company.

As space at this writing does not permit a lengthy description of the plant in detail, it is intended here to deal only with the solution of the engineering problems met with, and to confine the description to the condensing apparatus and coal and ash handling machinery.

The station, situated at the foot of Gold Street on the East River, as it existed until January, 1906, consisted of a boiler house and operating room facing the river, the building being of substantial steel and brick construction. The boiler house occupied a rectangular space 60 feet by 160 feet, and the generating room was 100 feet by 210 feet, the two being separated by a division wall. A plot of ground behind the station extended the full width of the property back of John Street, an area of 32,000 sq. ft.

In the operating room there were four 1000-hp horizontal cross-compound Allis-Chalmers engines, driving 750-kw, 25-cycle, 6600-volt generators. Space had been provided and foundations up to the basement floor built for two units of 1500-kw capacity, but these had never been installed. The ultimate output of the station as it stood would, therefore, have been limited to 6000 kilowatts.

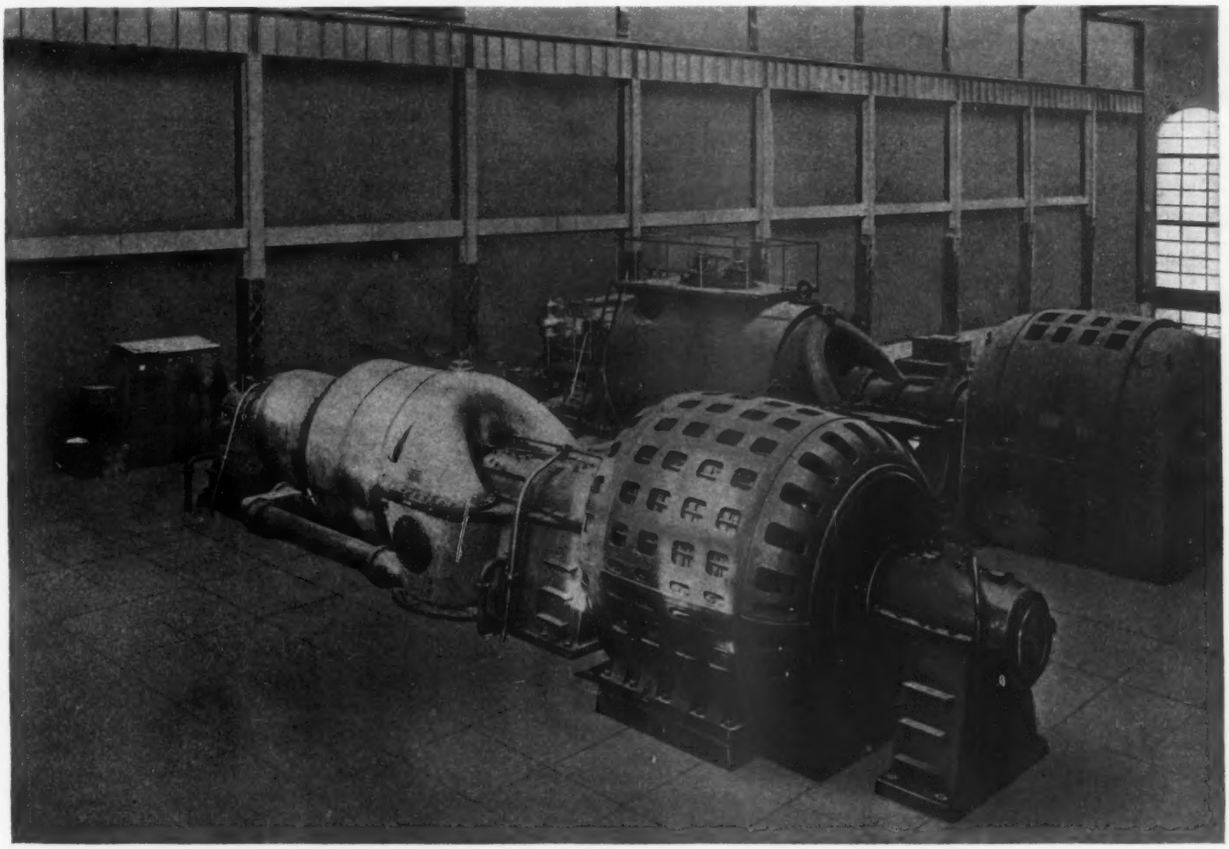


FIG. 1.—TURBINE ROOM, GOLD STREET STATION OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

In the boiler house there were installed six Stirling boilers of 500 hp each, with space for ten more of the same size. The coal bunker over the boiler house gave a storage capacity of, approximately, 4000 tons and was in first-class condition, but the old coal-conveying machinery on the dock was entirely inadequate for the needs of the new station.

In considering the possibilities of the situation, it was found, on laying out a general design, that the property could best be utilized for the development of a rated capacity of 60,000 kilowatts in turbo-generators, divided into eight units of 7500 kilowatts capacity each. As the new machines are to be guaranteed for a continuous overload of 25 per cent above rating and a maximum capacity of 50 per cent above normal for two hours, the capacity of the completed station at the peak will

reach a total of 90,000 kilowatts. The space in the old boiler house originally intended for the ten additional 500-hp Stirling boilers could be made to accommodate ten boilers of 750 hp specially designed because of the limited room, and when the steam consumption in the operating room had exceeded the possible supply from this building, the John Street area would be available for the construction of a new boiler house with 64 boilers of 650 hp each, and with bunker capacity for 15,000 tons of coal.

The first step in carrying out the plan was to construct condensing intake and discharge tunnels of sufficient capacity to supply the demand of the larger units, and as it was necessary to keep the old generators in commission over the winter peak of 1905-6, as soon as the contract for the tunnels was let the engines were connected to run non-condensing, and excavations for the tunnels began immediately.

The old coal conveying machinery was next dismantled, and to afford adequate foundations for the massive new structure and machinery, the old dock and pier were entirely rebuilt.

It was not until January 1, 1906, that it was possible to dispense with any one of the old generators in the operating room, and it was, therefore, not until this date that it was possible to dismantle the two engines which had to be removed before the foundations for the first turbine could be built.

In drawing up the plans for the installation of the turbines, it immediately proved necessary to increase the basement head room for the condensing apparatus and to increase the height of the crane above the engine room floor, as with the old equipment it would have been impossible to remove the cylinder covers of the turbines. Room was also needed for electrical auxiliaries and for the construction of masonry, high-tension switch and bus compartments and modern, distant control switchboard apparatus. To meet these various requirements, it was decided to raise the operating room floor of the whole station 6½ feet, to raise the roof of the operating room 18 feet, and to construct along the entire length of the station two mezzanine galleries for the electrical apparatus and for the station offices. The old 25-ton crane spanning the full width of the station was removed and new crane runways built 18 feet higher for a 50-ton crane spanning the area between the mezzanine galleries and the boiler house division wall. The columns supporting the mezzanine galleries and the

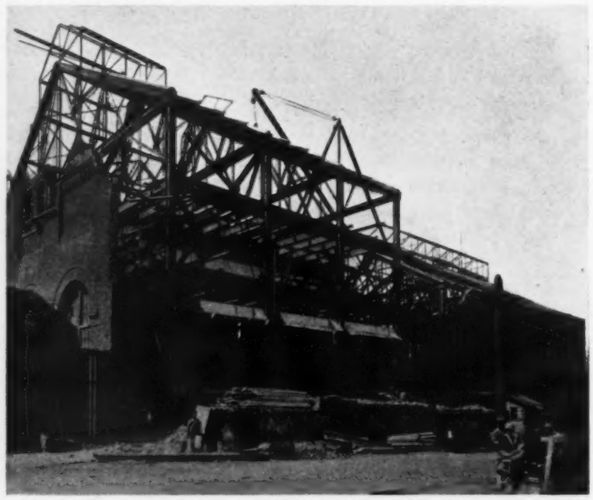


FIG. 3.—POWER HOUSE IN COURSE OF RECONSTRUCTION.

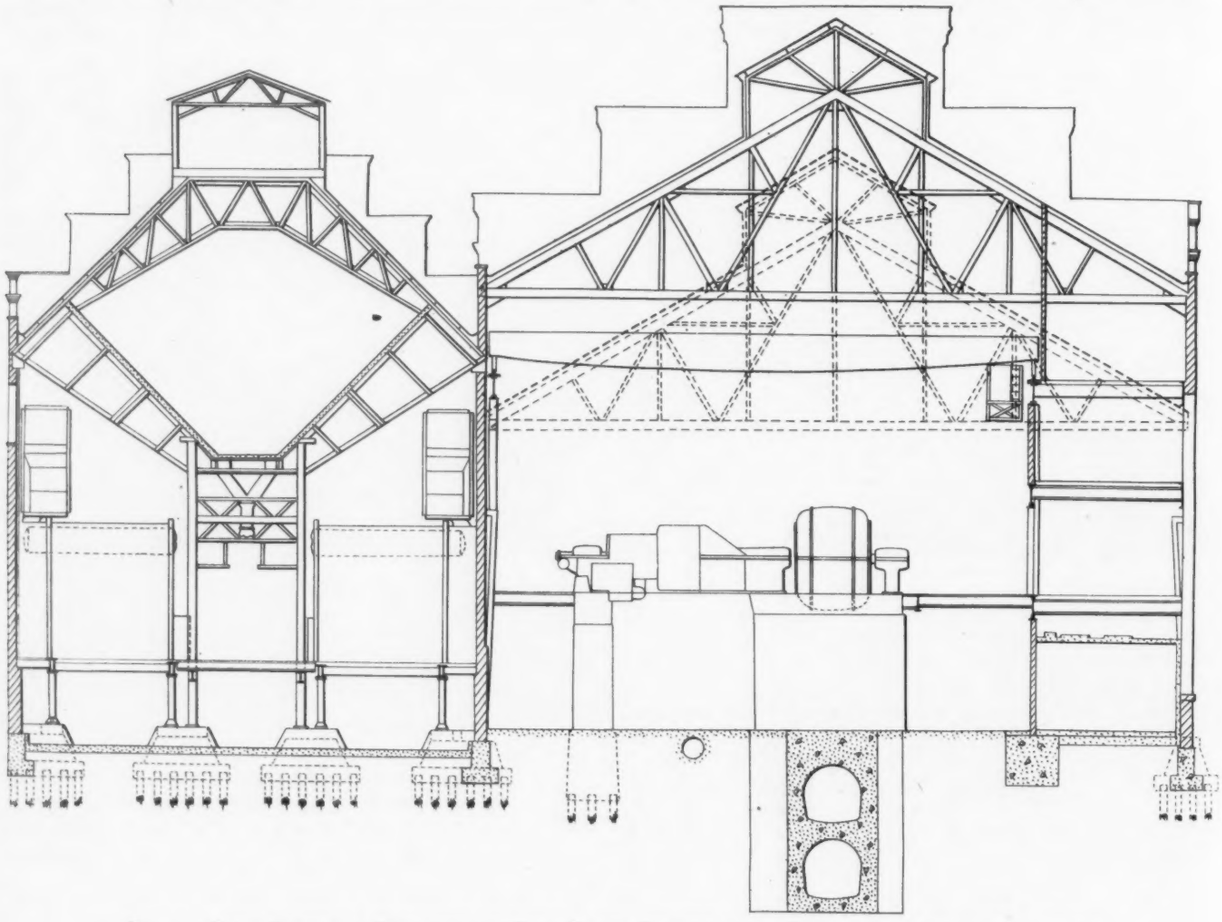


FIG. 2.—CROSS-SECTIONAL ELEVATION OF GOLD STREET STATION, WITH FORMER ARRANGEMENT INDICATED.

crane runways on that side would be heavily loaded, and it was necessary to provide adequate foundation for these without new piling, which would be very difficult to place while the condensing tunnel construction was under way. It was found that along the line of the new columns there were numbers of old piles, irregularly spaced but still in good condition, some under old floor columns and others supporting the old engine foundations. To take full advantage of these, a girder of reinforced concrete was constructed 7 ft. square in section and continuous throughout the length of the building, the bottom resting on the piles and the top being level with the basement floor. On this structure the columns' bases were set and the loading of the columns thus distributed over a wide area. The absence of settlement has justified the confidence of the engineers in this solution of the problem.

As the station roof was of the wood, tar and gravel type, with monitor above, the whole supported by 100-ft. span steel trusses, it was necessary to remove the entire roof, to raise the trusses one by one, and after the building columns had been lengthened to support the trusses in their new position, and to replace the roof with new covering. The fact that this work was started on the first of January and that, notwithstanding continuous bad weather, a long strike of the iron workers and other serious difficulties, the first turbine was delivering

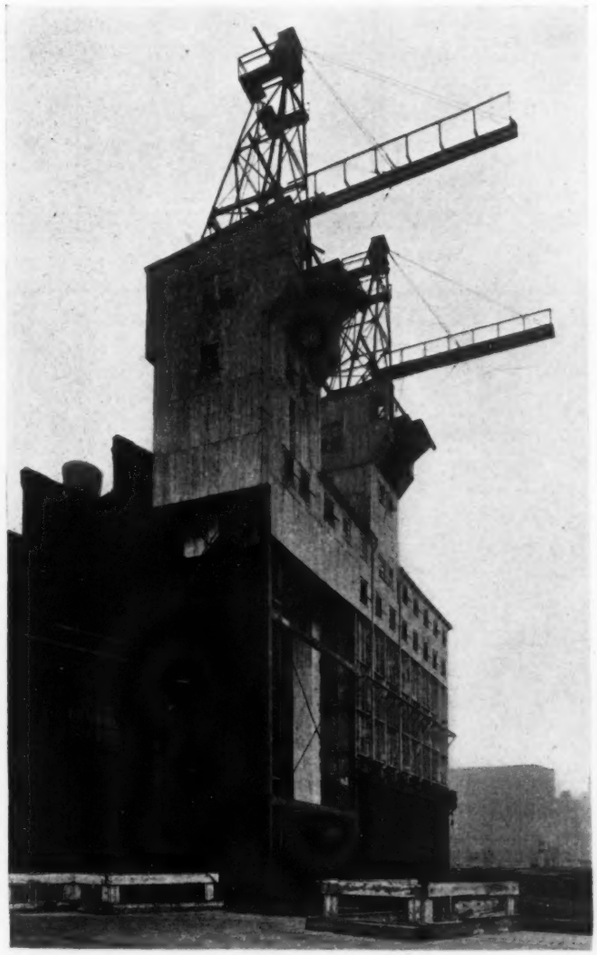


FIG. 4.—COAL TOWER, GOLD STREET STATION.

energy to the system under the new roof on the 16th of July, will indicate the rate at which the construction was carried on.

The first units to be purchased were two horizontal turbo-generators—one of 5000 kilowatt capacity and one of 7500 kilowatt capacity. While the alterations to the station structure were proceeding, reinforced concrete foundations on piling for the two turbines and their auxiliaries were constructed, and the condensing tunnels with intake and discharge wells at each turbine completed. On the 23d of June, 1906, the auxiliaries for the Allis-Chalmers turbine were started for the first time, and on July 16, the turbine was delivering energy to the system through temporary connections to the old switchboard, which had been left intact on a part of the old floor. In August the installation of the Westinghouse turbine was completed, this also being connected temporarily to the old switchboard, with the addition of brick-compartment, oil switches

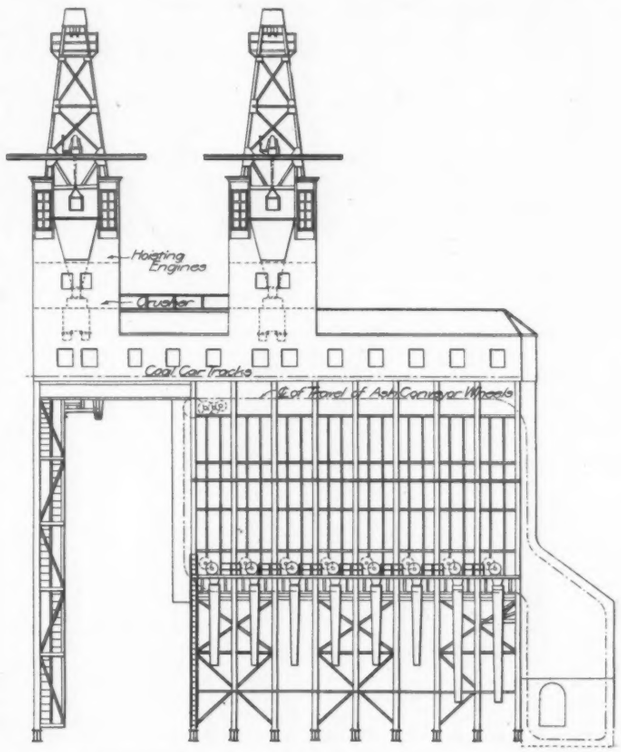


FIG. 5.—ELEVATION OF STATION SHOWING COAL AND ASH HANDLING EQUIPMENT.

and other apparatus necessary to handle the increased load. A third turbine, of the Allis-Chalmers type, will be installed during the coming summer, this unit to be of 6000 kilowatts capacity and equipped with Worthington condensing apparatus.

The position of the Gold Street station, situated as it is just beyond a bend in the river, makes it very difficult to handle light river craft at the pier, on account of the swiftness of the tides which sweep through the narrow channel at this point. In designing the dock and bulkhead, it was necessary to provide a structure which would withstand the thrust of heavily laden coal barges, afford protection for the condensing water screen well, and also furnish a stable foundation for the coal and ash handling towers. After the piling and timber of the old dock had been cleared away, the whole area between the building and bulkhead line was repiled on 3-ft. centers, the piles being then cut off at mean low water, capped with 12 by 12 timbers and a platform of the same thickness laid over the whole. On this platform were built the concrete foundations for the steel structure of the coal towers. Along the front of the dock and stiffened by the column foundations at right angles to it, a girder of reinforced concrete 8 ft. wide and the full depth from platform to pier level was constructed to prevent damage from the barges. Reference to the plan will show that the ash pocket occupies only about ⅔ of the area of the structure, the distance between the last columns of the ash pocket and the isolated columns at the end of the structures being open from the dock level to the floor of the coal tracks. Under this open space the concrete condensing water tunnels extend under the pier from the building wall to the bulkhead line, and in approximately the center of the space the intake screen well is

situated. On each side of the tunnels the structure of the dock is open, the piles extending up to the deck platform. In front of the screen well where the concrete girder construction was not possible, protection was afforded by means of steel beams spanning the space in front of the casting and supported at the ends by the column foundation on either side. The

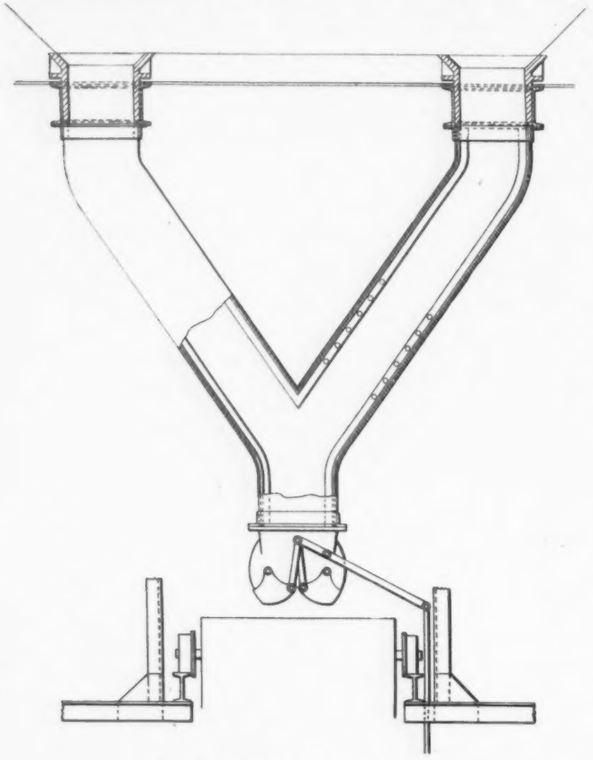


FIG. 6.—DETAILS OF COAL CHUTE.

usual face construction of buffer piles, fender strips and backing log with 4-in. plank deck over the open part of the pier completed the dock construction.

COAL AND ASH HANDLING MACHINERY.

The coal and ash handling machinery is housed in a structure of steel and concrete, which rises above the foundations to a height of 160 feet and occupies a large portion of the dock. The structure consists of a concrete-lined ash pocket, of 1200 cubic yards capacity with two coal hoisting towers and a floor between which is connected with and forms a continuation of the monitor over the boiler house. This monitor at the time

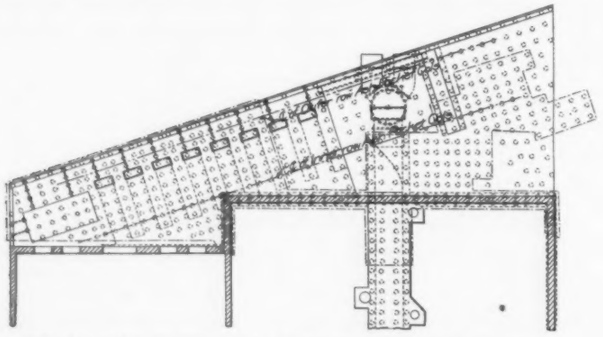


FIG. 7.—PLAN OF BULKHEAD SHOWING CONDENSER TUNNELS.

the other extensive alterations were made, was widened and its height increased to provide for a double track cable road.

Each coal tower is fitted with Mead-Morrison standard equipment, the hoisting machinery consisting of combined bucket and trolley engines, self-contained in one frame. One and one-quarter ton buckets deliver the coal into an outside receiving hopper from which it flows through the crusher into a second hopper which delivers it directly into 3-ton cars running on the double-track cable system at the level of the boiler house monitor. The cable car travels to any desired point over the bunkers, where the coal is dumped and the car returned on the other track.

The bottom of the bunkers consisted formerly of buckled steel plates, but it was found that these showed noticeable corrosion from the acid in the coal, making it necessary to line the bunker with concrete throughout. As the sides of the bunker were very steep, a means had to be found of holding the concrete in place against the smooth plates. To hold the concrete against the steep incline of the bottom of the bunker, a few rivets were cut out along the edges of each plate, and L-shaped bolts tapped in over the expanded metal, the hook of the bolt holding the reinforcement in place. Washers were inserted under the mesh to bring it to the desired position in the lining. As cinder concrete was used for the lining and a good size mesh for the reinforcement, it was not difficult to make a thoroughly substantial and lasting job.

At one end of the bunker and partitioning off about ¼ of its capacity for the storage of soft coal, a bulkhead of steel beams was constructed, this also being covered on both sides with concrete.

On account of the narrow firing aisle in the old boiler house

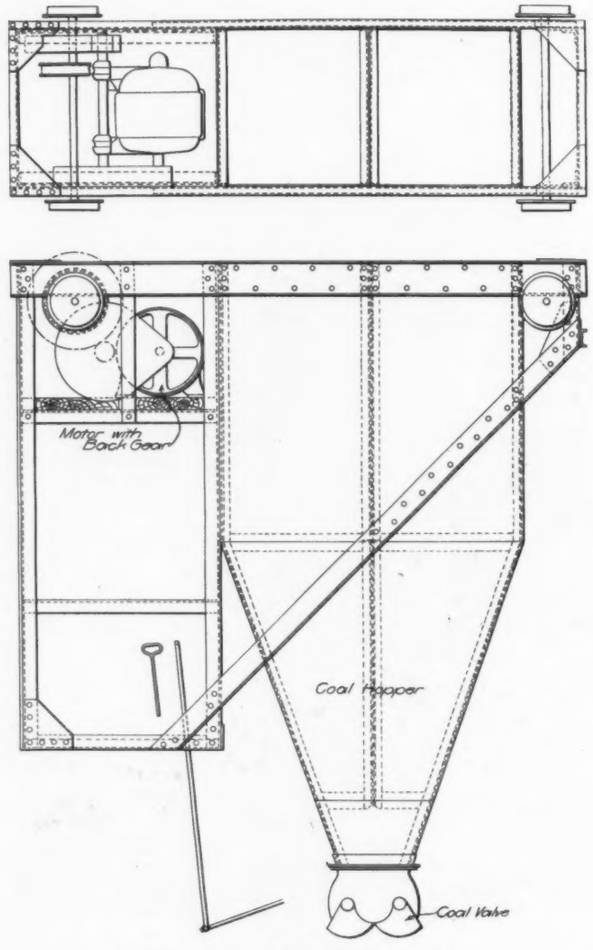


FIG. 8.—TRAVELING COAL HOPPER.

because of the installation of the larger boilers, it was not possible to deliver the coal by means of coal down-takes at the side of each boiler. It was also desired to mix a certain amount of soft coal with the anthracite screenings during the peak of the load. A means of accomplishing this which afforded ample operating room to the firemen, and which left the aisle

free for boiler repairs, was found in an electrically operated hopper traveling on a runway through the entire length of the boiler room aisle. This hopper, controlled from a convenient platform on the carriage, receives coal from gated chutes under either hard or soft coal bunkers and delivers this in any combination desired in front of the boilers. As this device can deliver in 10 minutes the coal consumed in an hour, it serves its purpose thoroughly without being in the way of the firemen.

The ashes from the hoppers under the individual boilers are delivered into cars operating on ash tracks in the boiler house basement. The cars are pushed out to an ash receiving hopper on the dock, and a conveyor of the endless McCaslin overlapping bucket type carries them up into the ash pocket, the buckets returning empty to the receiving hopper. On the river side, the ash pocket is equipped with six gated chutes for loading the ashes into scows, the chutes being hinged just below the gates so that they may be lifted to clear any interferences with cabin housings or other like projections on the barges at high tide. Both gates and chutes are operated from a platform extending the length of the pocket above them. In addition to the above, there is a large chute at the bottom of the ash bucket for emergency use to deliver ashes to trucks on the dock below.

CONDENSING EQUIPMENT.

The condensing equipment consists first of two concrete tunnels one above the other, approximately 8 feet in diameter and of horseshoe section, which extend from the end of the building through the center of the operating room to the river. The construction of the tunnels is shown herewith, the bottom of the intake being 21 ft. 6 ins. below the basement floor level, and approximately 13 ft. below mean low water. A wall of concrete 2 ft. in thickness separates the intake discharge from the tunnel, the bottom of the latter being 3 ft. below mean low water. Around both tunnels the concrete is not less than 2 ft. in thickness at any point, and is reinforced throughout. The suction wells are brought out at the side of the structure as shown, the bottom of the well being level with the bottom of the tunnel. The wells are 3 ft. 6 ins. in diameter, and the top is flush with the basement floor. The discharge connections are on the opposite side of the tunnel from the intake wells and are constructed of cast iron pipe one inch in thickness, 2 ft. 6 ins. in diameter and ending at the bottom with a long sweep elbow meeting the side of the dis-

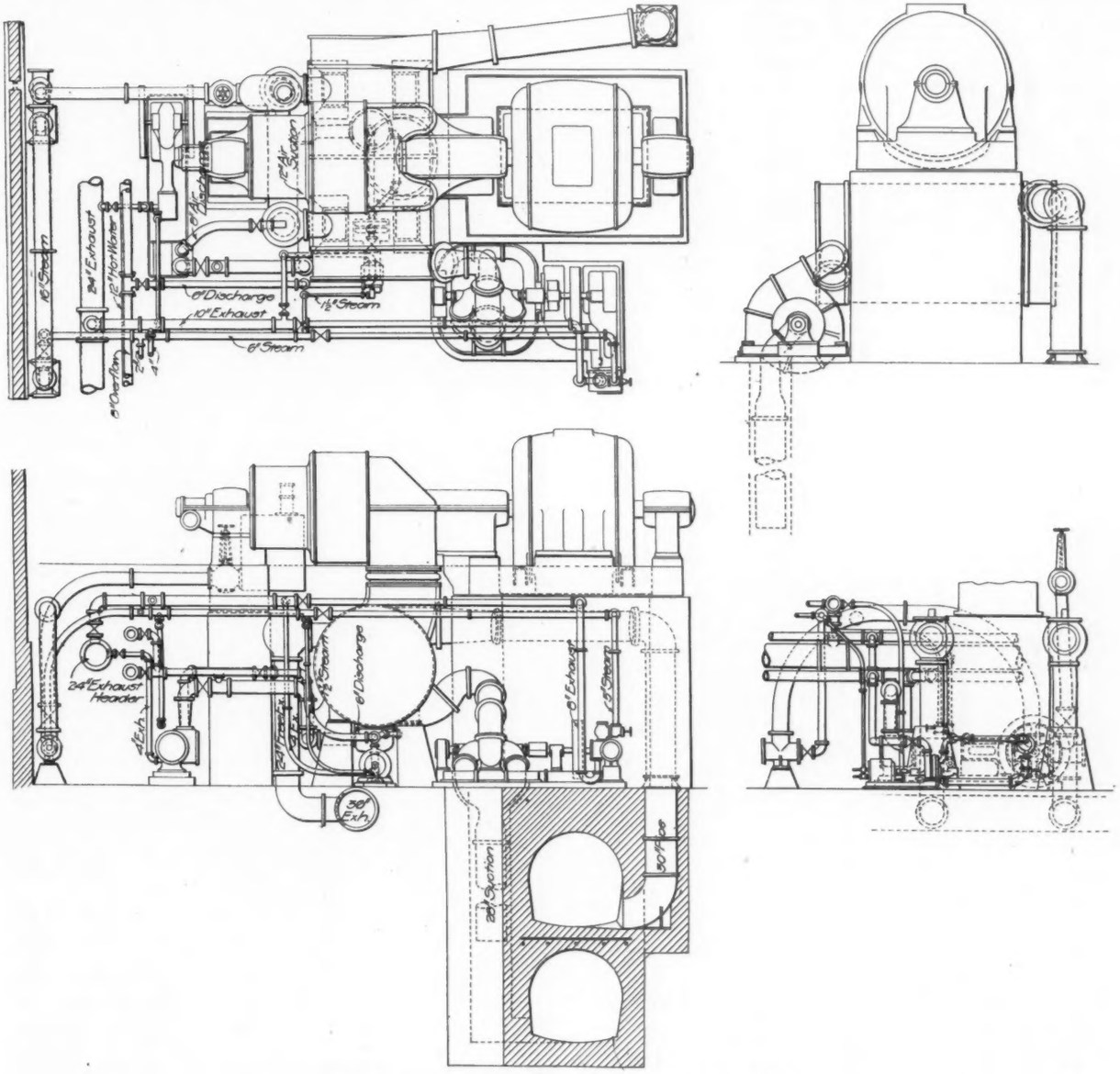


FIG. 9.—DETAILS OF CONDENSER EQUIPMENT FOR TURBINES.

charge tunnel at an angle of 45 degrees, the water being discharged in the direction of the line of flow. The top of the discharge pipe extends one foot above the basement floor level, and finishes with a flange for connection to the discharge piping from the condenser. Both intake and discharge openings are 30 ft. apart, the turbines being therefore set on approximately 30-ft. centers.

Both the condensing tunnels extend through the foundation of the north wall of the station and under the pier, the intake tunnel ending at the screen well some 20 ft. inside the bulkhead line and the discharge being diverted to the side, spilling between the concrete foundation at the end of the ash pocket and the screen well casting. The screen well consists of a heavy casting in three sections 10 ft. in diameter, and approximately 30 ft. deep over all. The bottom section rests on piles and has two openings 6 ft. in diameter blanked off at present, but intended for extensions of the same size out to the pierhead line when the volume of discharge water becomes great enough to affect the temperature of the intake. The middle section has two openings, 8 feet in diameter, one of which fits into the neck of the intake tunnel, the connection being packed with burlap for a depth of 2 ft. Inside the casting and against this opening are fitted the screens, space being provided for two, so that in changing for cleaning purposes, the second can be dropped in place before the first is lifted. The other opening is flanged, and at present is left open for the condensing water, the intention being to blank this off when the lower connections are extended. The upper section carries the guides for the screens and extends up to the deck of the pier. Openings are provided in the deck for removing the screens and when not in use these are covered with cast iron floor plates. The screens are easily handled by chain block and gear hung from the steel work of the coal tower structure above.

The condensing apparatus for the first turbine, the Allis-Chalmers unit, was manufactured by Henry R. Worthington, the specification requiring a vacuum of 28 ins. at the steam nozzle of the condenser with condensing water at 70° F. The condenser is cylindrical in form with hot well attached to the bottom of the condenser shell, and contains 18,800 square feet of cooling surface. The steam enters the top of the condenser, the non-condensible vapors being removed by the dry vacuum pump from the top of the hot well; the condensing water enters the condenser at the bottom and leaves the other

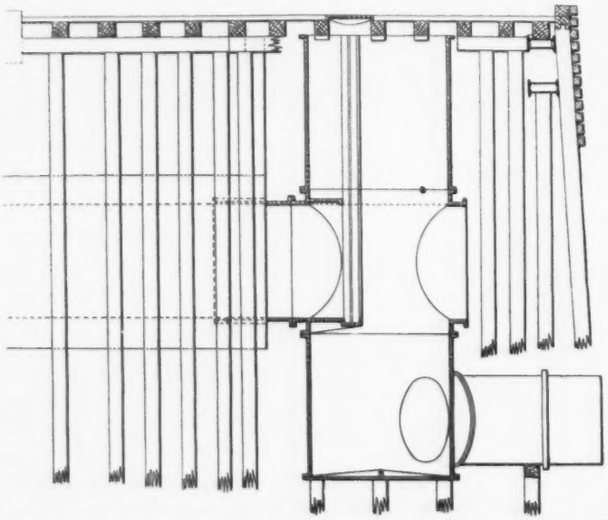


FIG. 10.—SCREEN WELL AND ENDS OF CONDENSER TUNNELS.

end at the top, the condenser therefore, being of the counter-current type. The circulating pump is of the volute type, having side suction and enclosed vane impeller, motor-driven by a 200-hp direct-current motor. The dry vacuum pump is of the well known Worthington center crank type, the vacuum cylinder being provided with water jackets and the discharge valves so connected so as to be adjustable when the unit is running. The wet vacuum pump is of the horizontal two stage centrifugal type, driven by a 30-hp direct-current motor. The turbine is connected to the condenser through an expansion joint of special design, adapted to the short distance of 12 ins. between the flange of the exhaust nozzle on turbine, and that of the condenser, as shown. This expansion joint consists of two separate cast iron flanges, connected by means of an annular copper ring so bent and riveted to the flanges as to occupy the

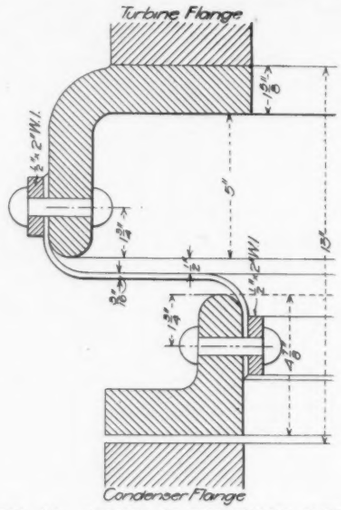


FIG. 11.—DETAILS OF EXPANSION JOINT.

least possible space. The atmospheric discharge is taken from the top of the condenser from two 24-in. openings each of which is fitted with a 24-in. angle atmospheric relief valve. The atmospheric exhaust piping leads directly down to an exhaust tunnel extending the full length of the building with risers at each end extending above the roof. This construction removes a mass of exhaust piping of large size from the basement of the operating room, thus leaving this space free for other piping to which frequent access is necessary.

The condensing equipment for the second turbine, the 7500-kw Westinghouse machine, was furnished by the Alberger Condenser Company, under practically the same specifications as for the first. The condenser for this unit is rectangular in form, the three passes being horizontal instead of vertical, and contains 25,000 square feet of cooling surface. This condenser is also of the counter-current type. The circulating pump is of the centrifugal type, motor-driven with double Siamese balanced suction, thus dispensing with end thrust of the shaft. The dry vacuum pump is of the horizontal pattern having steam and vacuum cylinders mounted on common bed plate, the steam cylinder being between the vacuum cylinder and the shaft. The wet vacuum pump for this condenser is also of the two stage centrifugal type, motor driven.

The third turbine, a 6000-kw Allis-Chalmers unit, to be installed during the coming summer will be equipped with Worthington apparatus similar to that for the first turbine. The heads of the condenser, however, will be of increased depth over that of the 500-kw unit, and the circulating pump will be steam driven by a Fleming horizontal engine. The wet vacuum pump will be of the same type as those of the other two units but will be driven by a Kerr steam turbine at 1200 r. p. m. The foundation for this turbine and its auxiliaries has already been built and the turbine will be in operation in September for the fall load.

It is hoped in a future article to give a more complete description of the Gold Street station which will include the electrical machinery, switchboard apparatus, piping systems and the new boiler house. The transmission of 50,000 hp of steam at 180 lbs. pressure an average distance of 400 feet from the boiler without serious losses, and the extension of the coal handling equipment over the roof of the present station are some of the problems which have occupied the engineers of the company, and which will be dealt with.

Washington Convention of the National Electric Light Association.

In the ELECTRICAL WORLD of last week an account of the proceedings of the National Electric Light Association at Washington, June 4 to 7, was given for the sessions of Tuesday and a part of Wednesday. The remainder of the Wednesday proceedings, together with those of Thursday and Friday, are given in the following pages. The general plan of the convention was to hold two sessions per day for the reading of papers and on the first three days of the convention these sessions were held morning and evening, leaving the afternoons open for entertainment. The entertainment features of the convention were beautifully carried out. Washington is an ideal place to visit at this time of the year, and this fact, together with the arangements made by the local reception and entertainment committees, made the convention one of the most enjoyable that has ever been held. In general interest and attendance at the sessions it was a decided advance over any N. E. L. A. convention heretofore held, and a number of important matters were presented and action taken. Unfortunately the programme was so filled with papers that on the great majority of subjects there was practically no opportunity for discussion. The programme in its entirety included some 70 papers and committee reports, some of which, however, were presented by title only. As described in last week's issue, the exhibits were held on the tenth floor of the New Willard Hotel in the banquet-room adjoining the ball-room in which the convention met. One of the new features this year was "Commercial Day," which was the last day of the convention. It was given over entirely to short papers and discussions relating to the commercial and new-business departments.

The ladies were well taken care of by automobile rides, theater parties and visits to points of interest during times when the convention was in session. Tuesday afternoon President Roosevelt received the members and guests at the White House, at which time about 900 availed themselves of this opportunity to meet the President. The courtesy of this reception was much appreciated by the convention, as expressed by a resolution passed the last day.

A resolution was also passed acknowledging the courtesy of the ladies of the District of Columbia; Hon. H. B. F. Macfarland, president, and the other members of the Board of Commissioners of the District of Columbia; Col. C. A. P. Hatfield, U. S. Army; The Columbia and Chevy Chase Golf Club; Mr. G. T. Dunlap and Mr. D. S. Carll, of the Capital City Traction Company; Mr. F. B. Hubbell and Mr. T. P. Garrett, of the Washington, Arlington & Falls Church Railway Company; Gen. George H. Harries, Mr. H. W. Fuller, Mr. E. S. Marlow, and Mr. L. E. Sinclair, and others of the local member company, and generally the members of the Entertainment Committee.

On Wednesday afternoon the convention visited an exhibition cavalry and field artillery drill at Fort Meyer. On Thursday afternoon the convention was taken to Mount Vernon by boat to visit the home of Washington. Lunch was served on the boat. On Friday both morning and afternoon sessions were held.

DISCUSSION ON NEW SPECIFICATIONS FOR STREET LIGHTING.

In the report of the convention last week, on page 1163, was published an abstract of the very important report of the committee which recommended specifications for street lighting. The committee consisted of Messrs. Dudley Farrand, A. E. Kennelly, Chas. P. Steinmetz, Louis A. Ferguson and Paul Spencer. The important and radical feature of these recommendations, which was adopted, was that the rating of street lamps in contract specifications should be in terms of the mean normal illumination cast at a considerable distance from the lamp along the street which it illuminates. In other words, illumination rather than watts or candle-power is the thing specified. In view of the great importance of this action and the careful consideration given it by the convention before action was taken, an abstract of the discussion which preceded the adoption of these recommendations is here given:

Dr. C. P. Steinmetz was called upon to address the convention, which was the first one of the organization that has been favored by his presence for many years. He reviewed briefly the advances recently made in efficiencies of both arc and incandescent lamps, which made necessary new forms of contracts for street illumination. Referring to the progress in arc lamps more in detail, he classified the recent arc lamp under two general headings, the flame arc, in which the light is obtained from salts with which the carbons are impregnated and luminous arcs using the oxides of iron and titanium, in which the metallic oxides act as an electrode to conduct the current. He recalled that a few days after the first news of the flaming arc lamp reached him in this country an experiment was tried with a magnetite luminous arc. Since he had always felt kindly to the magnetite arc it was a matter of gratification to him upon attending this convention to find from the exhibits that the magnetite arc is no longer a special apparatus made only by one manufacturer. Reviewing relative efficiencies briefly he mentioned the flame arc, the luminous arc, and the mercury vapor lamp as all consuming considerably less than one watt per candle. After these with a consumption of from one watt per candle upward are the tungsten incandescent lamp, the common carbon arc, the tantalum lamp, the Gem lamp, the Nernst lamp, the Moore vacuum tube, and the old-fashioned incandescent.

Mr. V. R. Lansingh thought that efforts would be devoted in the future to directing the light of a lamp lengthwise of a street instead of having so much crosswise, illuminating buildings and vacant lots as we are now doing. Very little has been done as yet along this line.

Mr. W. D'A. Ryan said that he had been assisting the committee by carrying on the tests the results of which are to be used in the tables which the committee is to present later, giving the foot candle illumination at distances of from 200 to 300 feet from the principal common illuminants used in street lighting. He said that some trouble is being experienced in measuring illumination of such low intensity, principally owing to the fact that with such low intensity as is obtained at the specified distance a light with considerable blue and violet in its rays can produce an illumination which as measured by the illuminometer is higher than that obtained by calculation because of the greater sensitiveness of the eye to violet rays at low intensities. He thought that in considering street illumination from arc lamps only the illumination from 100 to 700 feet distance from the lamp is the thing to be considered, and that the illumination near the lamp could be left out of account. Referring to the Colorado Springs controversy over enclosed versus open arc lamps he expressed the opinion that for effective illumination in ordinary everyday practice the light obtained from a 450-watt, alternating-current, enclosed arc is likely to be better than that obtained from a 450-watt, open, direct-current arc.

Dr. E. P. Hyde endorsed the action of the committee but raised some question as to whether the normal illumination—that is, the illumination at right angles to the ray of light—is really the effective illumination on the street.

A motion was then made to continue the committee for another year so that it might complete and amplify its report. This motion was immediately amended by Mr. L. A. Ferguson to the effect that the recommendations of the committee be adopted and that the committee be continued to complete its report and that the report when completed be published subject to the approval of the executive committee. He thought that there was urgent need for the adoption of this report and that the matter ought not to wait another year.

Mr. Preston S. Millar criticized the report mainly because of the practical difficulties of measuring such low intensities of illumination as would be necessary under such specifications. The normal illumination measurement is practically a measurement of candle-power and he therefore failed to see why the plan should be recommended of measuring the candle-power at a great distance from the source of light in a street rather than measuring it nearer to the lamp at the same angle below the

horizontal. Photometry, or measurement of candle-power, is admittedly difficult, but measurement of illumination on a street is even more so because it involves all the difficulties of photometry and some others not experienced in the laboratory.

Dr. C. P. Steinmetz, explaining the action of the committee, said that the reason the illumination of the street rather than the candle-power at the equivalent angles was taken as a basis for contract was that it was desired to get comething which could be easily understood by the non-technical man. Now anyone can comprehend what is meant if a contract is explained to require an illumination on the street equal to that produced by, for example, a standard 16-cp incandescent lamp placed a certain number of feet away. Illumination is a matter which can be easily explained. There is no such thing as getting up a standard form of contract as some members had suggested, because there are at the present time too many different kinds of illuminants. He thought it of importance to adopt this new basis for contracts, namely, illumination delivered on the street, rather than to continue under the old plan of selling street lighting on a basis of the power consumed by the lamp. Under the latter basis the new illuminants which are of higher efficiency would be practically excluded, as a company would be offered no premium for adopting them and incurring the exepnse of a change. After some further discussion the amendment offered by Mr. Ferguson which carried with it the adoption of the report of the committee and the continuance of the committee to complete the report was unanimously carried.

The report of the committee on the Present Methods of Protection from Lightning and Other Static Disturbances was read by Mr. Robert S. Stewart, of Detroit, in the absence of Mr. Alex. Dow, chairman. An abstract of this appeared on page 1162 of last issue.

The paper on electric heating without special concessions from the central station was read by Mr. C. D. Wood, Jr., an abstract of which follows.

ELECTRIC HEATING.

The paper gave a considerable amount of valuable information on the cost of electric heating and the advantage of using electricity for such purposes. He stated that the period of experimenting and testing of heating devices, the pitting of one manufacturer against the other, is drawing to a close, and the present problem is the applying of the devices at hand to the existing conditions. It was shown that where the flat-iron is used an average family of five persons consumes about 13.2 kw-hours per month, which represents at a 10-cent rate an income to the station of $15.84 per year. An electric clothes-dryer arranged for heating a cabinet 8 ft. high, 8 ft. wide and 8 ft. deep during the months of July and August, 1906, consumed about 100 kw-hours per month and the dryer was satisfactory in every respect. The average consumption of an 800-watt plate-warmer is 24 kw-hours per month. An electric sterilizer employed by physicians, using about 800 watts, consumes 200 kw-hours per month.

The bookbinding industry affords an excellent opportunity for electric heat. It is possible to supplant gas heated embossing presses with electric heating units and make a very fair comparison with gas when electricity is sold for 5 cents per kw-hour. A large electric embossing press is rated at 220 volts and 16 amperes. The machine reaches a temperature of 354 degrees Fahrenheit with a consumption of 4.07 kw-hours starting with a room temperature of 75 degrees. The monthly cost of energy for the past year for this work at a 7-cent rate was $8.05 per machine. The energy consumption of a two-quart glue-pot averages 1.3 kw-hours per pot per working day; at an average rate of 5 cents per kw-hour, the cost of operation with electricity is less than with gas. The power consumption of a machine for welding iron bands used in the trunk industry is about 1.6 kw., when making welds at the rate of 480 per hour. At a 10-cent rate the cost per weld is .02 cents. The cocoa and coffee trade has applied electric heat to its small desiccating or drying cabinets. A dryer 3½ ft. x 2 ft. x 5 ft., requiring a temperature of 150 degrees, uses about 75 watts per cubic foot when properly jacketed. One heater of this kind has brought in a revenue of $11.00 per month to the central station. A chocolate heater consuming 50 watts produces heat enough to keep the chocolate in working condition. The manufacturers of switchboard and telephone supplies find a useful economical tool in the electric soldering iron. A 1.5-lb. soldering iron consumes 70 watts. It has been found that irons supplied with electricity at 5 cents per kw-hour cost less to operate than soldering furnaces using gas at $1.00 per thousand cubic feet. Although little has as yet been done in the introduction of electricity for complete commercial ranges, there are in New York City six or eight electric kitchens in operaation. The average consumption of these outfits is 10 kw. A few restaurant broiler sets are now in use. Each broiler brings in a revenue of about $12.50 per month to the central station. The author stated that one manufacturing company in central New York is preparing food daily for 2000 employees, all of which is cooked by electricity.

WEDNESDAY EVENING'S SESSION.

On Wednesday evening Mr. Edward A. Norman presented his paper entitled "Efficiency of Various Methods of Illumination," contents of which were summarized on page 1163 of last week. This was followed by the paper by Dr. A. E. Kennelly and Mr. S. E. Whiting on "Frequencies of Flicker at which Variations in Illumination Vanish," an abstract of which follows.

FLICKER AND VARIATIONS IN ILLUMINATION.

The paper gave an account of the results of experiments on the cyclic variation in illumination due to current frequencies. Among the conclusions from the experiments are that the frequency at which flicker ceases to be visible is approximately the same for different observers with normal sight. The maximum frequency of vanishing flicker with stationary target and stationary eye is in the neighborhood of 66 cycles per second. Vanishing-flicker frequency increases in all cases when the illumination on the target is increased, but in nothing like the same proportion. The increase of vanishing-flicker frequency is rapid for increasing illuminations below 0.5 foot-candle and 100 per cent range, and increases but slowly for illuminations exceeding 1 foot-candle. Vanishing-flicker frequencies are less with colored targets than with white targets, for equal illuminations and sizes of retinal image. The vanishing-flicker frequency does not depend appreciably upon the mean illumination on the targets, but depends on the maximum and minimum cyclic illuminations. It does not depend appreciably upon the manner in which the illumination varies in passing between the maximum and minimum cyclic values. The vanishing-flicker frequency increases somewhat with the area of the target, for a given surface quality of the latter, distance from the eye, and incident illumination, and increases somewhat as the target is approached to the eye, for a given size of target and intensity of incident illumination. The greater the range of flicker, i. e., the ratio of difference in cyclic illumination to the maximum, the greater the vanishing-flicker frequency, but in nothing like the same proportion. The smallest range of flicker that was found to be recognizable with certainty was 1.4 per cent, observable only at a low frequency. The most sensitive flicker frequency for small ranges of flicker was in the neighborhood of 2.5 cycles per second. Flickering ceased to be objectionable with ranges less than 7.5 per cent. The conditions favoring disagreeable flickering with fixed target and fixed eye are powerful illuminations, larger flicker ranges, bright surfaces of large area, and low flicker frequency. The sensation of flicker may be gauged in intensity by the vanishing-flicker frequency, or the frequency necessary to make the flicker disappear. The law of flicker sensation in relation to flicker stimulus is similar, or at least substantially similar, to the law of steady luminous sensation with steady luminous stimulus, which is generally admitted to be in accordance with the Weber-Fechner law. Constant ratios of increase in flickering illumination are accompanied

by equal increments of vanishing-flicker frequency. Doubling the intensity of flickering illumination, everything else being unchanged, adds approximately 3.3 cycles per second to the vanishing-flicker frequency, no matter what the size, color or condition of the objects viewed; provided that their images on the retina are fixed (stationary objects and stationary eye). The vanishing-flicker frequency plotted as ordinates, on uniform scale, to illumination as abscissæ, on a logarithmic scale, gives observation points falling approximately upon a straight line. Such straight lines in different series of observations with different targets and ranges of illumination appear to be parallel. The vanishing-flicker frequency is 11 times the common logarithm of m times the illumination view by the eye; where m is a numerical constant depending upon the size, color, quality and distance of the object illumined, as well as on the range of flicker. With one exception, m was found approximately proportional to the flicker range, other things being equal.

Mr. J. R. Bibbins presented in abstract his paper on "Application of Gas Power to Central Station Work," an abstract of which follows.

GAS ENGINE EQUIPMENTS FOR CENTRAL STATIONS.

After a description of the proper arrangement of the power plant and the selection of the fuels, and discussing the automatic devices used with the gas producers on the engines, the plant now operated by the Firth-Sterling Steel Company, at Giesboro Point, near Washington, was treated in detail as a good example of the simplicity characterizing the gas producer plant. Each gas unit consists of a water-sealed producer and a wet coke scrubber with a three-way valve between, connecting with the purge stack. The plant is designed for continuous running and ashes are removed at intervals through the water wheel without disturbing its operation. An excellent form of coal handling apparatus is in use. A simple elevator serves each pair of producers by gravity from an elevated hopper. Elevator boot and producer blowers are contained in a concrete pit covered by steel fore plates which effectively confine the influence of the latter and provide ready access. An automatic regulator controls each producer independently of the other, so that gas is delivered to the engines at a uniform pressure without the interposition of any storage capacity whatever except that of the gas main. The use of individual scrubbers in place of a central scrubbing plant has the rather important advantage of permitting independent continuous running. A reserve scrubber would otherwise be necessary so that carrying out the simple unit system in the gas as well as in the engine plant imposes more serious burdens.

A plant similar to the above is in use in Keene, N. H. This plant, which serves a general 24-hour lighting system, is rated at only 270 kilowatts capacity. With coal at $4.60 per ton this small plant is able to generate energy for a total operating cost of approximately 1 cent per kw-hour. With regard to the repairs of gas plants, it may be stated that a plant has been in operation at Bradford, Pa., for nine years and for the past four years has shown an average heat consumption of 24,000 B. T. U. per kw-hour on a 20 per cent load factor. The average repairs for eight hours on the gas engine equipment, consisting of five engines, is $284.44, which represents only .7 per cent on the investment on the engines and indicates an extremely low rate of depreciation. The author stated that a certain 500-hp plant operating the electrically driven industrial works of the Norton Company at Worcester, Mass., running 10 hours per day on about three-quarters load, generates energy on a consumption of about 1.8 lbs. of coal gasified per kw-hour, including 14 hours daily stand-by, or 2 lbs. per kw-hour including extra fuel used for building new fires weekly. This result is equivalent to a net heat efficiency of 13 per cent from the coal pile to the switchboard. Preliminary figures on the comparative cost of gas and steam power for this particular plant indicate some 14 per cent saving in favor of gas, taking into account both the operating and the fixed charges.

A paper by Mr. Louis Nixon on "The Future of the Gas Engine" was read by Mr. Wells. An abstract of this follows.

THE FUTURE OF THE GAS ENGINE.

Mr. Nixon claimed that the cost of producing electrical energy by means of a gas engine and a producer plant is only one-half of that when steam engines are used. A steam turbine is an excellent prime mover, but it requires a large investment in boilers and a correspondingly large expense for generating steam. In a gas producer plant the boilers are eliminated. Although the gas engine is newer than the steam engine, it is much simpler, a fact that will be fully appreciated when it is remembered that almost any one can operate a gasoline automobile. The constructional features that render the gas engine equipment preferable to a steam engine equipment are the absence of boilers, pipe lines and draught mechanisms and the elimination of all stand-by losses. The author expressed the opinion that the gas engine is destined to play an important part in all future central station installations.

This paper was not discussed on account of lack of time.

LIGHTNING AND LIGHTNING PROTECTION.

One of the most important events of the convention proved to be the lecture by Dr. C. P. Steinmetz on "Lightning and Lightning Protection." As President Williams remarked after the lecture, Dr. Steinmetz's discussion of lightning phenomena will in the future be looked upon as the classic discussion of that subject. In his opening remarks Dr. Steinmetz stated that the earliest work in the investigation of lightning phenomena was conducted by Benjamin Franklin, who developed the lightning rod. He called attention to the fact that the most interesting photograph now in existence of a lightning stroke is one showing the city hall in Franklin's home town being struck by lightning. The investigations of Faraday led to the discovery of the fact that practically absolute protection from external electrical disturbances may be obtained by using shields of perfect conductivity around the apparatus. It is not possible to surround a transmission line with a perfect shield, but a cagework of high electrical conductivity can be placed over the transmission circuits. One of the most important features to be considered in the protecting cage is the conductivity. It is improper to assume that wires of high resistance placed above a transmission line will afford perfect protection.

Although it is not proper to investigate lightning phenomena by observing the actual lightning supplied by Nature, it is convenient to duplicate lightning effects by the use of high voltage at high frequency. It is possible at the present day readily to obtain e. m. f.'s of 300,000 volts or higher for experimental purposes. Experiments show that the air under ordinary pressure will withstand an electrical stress of about 10,000 volts per inch between needle points. Although the air does not break down until the maximum voltage is reached, a brush discharge appears at a very much lower e. m. f., and as the e. m. f. is increased the brush discharge enlarges until it covers probably 60 per cent of the total distance, after which a slight increase in the voltage will cause a discharge to pass between the terminals.

Observations of lightning strokes have indicated that often lightning travels from cloud to cloud over a total distance of at least two miles. This fact, combined with the observations mentioned above, has led various persons to assume that the e. m. f. of lightning reaches many millions or even billions of volts. Such, however, is undoubtedly not the case. Dr. Steinmetz showed that a fair estimate of the energy contained in a lightning stroke may be obtained from the illuminating effect, using the eye as a detecting instrument. A two-mile lightning flash sometimes appears to contain sufficient energy to evaporate about nine pounds of water; that is, about 10,000 kw-seconds.

Dr. Steinmetz explained at great length the production of the e. m. f. which results in the lightning stroke. He stated that even under normal atmospheric conditions an e. m. f. of 100 volts per foot vertically is found between the different strata of the air. This e. m. f., however, would normally produce very little current because the stored energy is extremely small. The moisture in the upper layers of the atmosphere combines

into drops which carry electrostatic charges. As these drops combine to form larger drops the potential is raised. This will be appreciated when it is remembered that the capacity of a sphere is proportional to the diameter, which increases as the square root of the number of drops combined into one, while the total charge increases directly as the number of drops. As the drops become larger and larger the potential gradient between adjacent drops, which in any event is non-uniform, may exceed the break-down strength of the air locally. As the air breaks down at one point, the potential gradient becomes increased suddenly at each side of the break-down point, and the electrostatic strain with a resultant break down spreads over enormous distances. Dr. Steinmetz estimated that a flash of lightning might occupy the total time of one five-thousandths of a second. The wave length of such a flash might probably be three-quarters of a mile. One can easily imagine, therefore, the disastrous effects which may be produced in neighboring circuits, even though the lightning stroke does not reach the transmission lines.

Although it is possible to protect electrical apparatus quite fully from external disturbances, it is not possible to afford perfect protection against internal disturbances. The greatest damage to electrical apparatus which is produced by lightning may be attributed to the subsequent internal effects rather than to the initial external causes. For protection against external disturbances, the overhead grounded conductor is the best possible device. Although a horn arrester serves admirably for removing any abnormal electrostatic charges from a transmission line, it is disadvantageous on account of the fact that when a discharge passes across the arrester the internal disturbance produced by the dynamo current results in a complete shut-down of the plant. The multi-gap arrester is likewise not exceptionally good, because it produces a short circuit for one-half of the wave, the short circuit being removed when the e. m. f. reverses. On a direct-current system a storage battery affords excellent protection because it acts as a short circuit for any excess voltage on the circuits, but does not short circuit the generators. One of the most important developments in lightning protective apparatus during recent years has been the arrester each element of which consists of two plates of aluminum immersed in an electrolyte. The aluminum cell has no fixed counter-voltage, but it attempts to assume an e. m. f. proportional to the impressed voltage. Thus, when it is first connected across the line, it acts as a direct short circuit. There is soon formed, however, a film, which acts as an insulating medium for a certain voltage, depending upon the thickness of the film. Under normal operation the film assumes a thickness proportional to the maximum value of the normal voltage. If this maximum value is exceeded, the excess of voltage produces a current through the cell; if the voltage continues to exist the film assumes a greater thickness. In case of sudden abnormal rise in voltage, the cell acts as a direct short circuit and relieves the line from the stress due to the voltage rise. The aluminum cell has a flywheel effect on any fluctuation of the e. m. f. The cell arrester is not perfect, however, in that it consumes a certain amount of power which must be dissipated in the form of heat; thus the radiating surface must be fairly large and the completed apparatus occupies a fair amount of space. For the electrolyte of the cell use must be made of a substance which is chemically permanent and electrically stable. It is not proper to use a spark-gap in series with the arrester because the most desirable characteristic of the arrester is the counter e. m. f. phenomenon, which is absent when a gap is used. Dr. Steinmetz stated that considerable credit is due to Prof. E. E. F. Creighton for his work in the development of the alluminum cell arrester.

Upon motion by Mr. L. A. Ferguson, which was seconded by Mr. Alexander Dow, a unanimous vote of thanks was given to Dr. Steinmetz for his most instructive and valuable contribution to the National Electric Light Association.

THURSDAY MORNING'S SESSION.

On Thursday morning Mr. Robert T. Lozier presented a paper entitled, "Producer Gas Engines for Central Station Work." This was illustrated by stereopticon views of large gas engines and gas engine power plants. An abstract of this follows.

GAS ENGINES AND PRODUCERS FOR CENTRAL STATIONS.

In his paper Mr. Lozier considered the fundamental principles on which the gas engine and producer work and the application of this apparatus to central stations. In discussing the fuel consumption he stated that the steam engine has inherently and under the best theoretical conditions only 56 per cent of the thermal efficiency of the gas engine. This statement was based on the actual thermal efficiencies of the two engines. In the design of gas engines the prime requisite is to burn the greatest amount of gas with the smallest amount of radiating surface under the highest possible compression without prematurely firing the gas. Practically every point of design centers about this principle. Although the variation in the angular velocity of the gas engine is greater than that of the steam engine, it is possible to operate 60-cycle generators in parallel when driven by three-cylinder, single-acting gas engines, provided belts or flexible couplings are interposed between the engines and generators. Twenty-five-cycle apparatus can be operated in parallel without such a flexible connection. The author considered separately three problems, the first relating to the new moderate-sized central station about to be projected; second, the already existing central station, whose steam layout is so uneconomical as to make it profitable to substitute a more economical plant; third, the already existing large steam central station with its capacity, as well as that of its feeder system, overtaxed. In the first case the fact that the station can be located near the center of the town because of the absence from smoke is one advantage in its favor; on the other hand, the inability of the gas engine plant to carry heavy overloads is an off-set. To determine if such an installation is profitable, it is necessary to take into account all the conditions and include them in an equation, the result of which should determine accurately just which type of plant can operate most profitably under the local conditions. The author showed that a small central station of, say 500-kw, running under uneconomical steam conditions and struggling to meet the interest on its bonded indebtedness, can effect a saving of 16 per cent on the total cost of delivering the energy to the meter by the installation of a new steam plant, while a gas plant will save 23 per cent. In the case of the already existing large steam central station, the author found the fuel cost about 2 mills per kw-hour in favor of the gas engine plant. The investment charge will be the same with either type of plant, the labor cost the same, but in the case of the gas plant one is able to obtain all the advantages of a self-generating sub-station distribution without increasing the cost to generate a kw-hour. The author stated his belief that the conditions best suited to the gas engine operation are those of high load factor, because it is in this respect that the gas engine is able to make its largest saving, and offset possible high interest and depreciation charges because of its higher first cost. This can, of course, be determined for each instance by working out an equation in which all the elements are included.

The discussion of Mr. Lozier's paper was participated in by Messrs. Ferguson, Keilholtz, Camp, Martin, McCabe and Sands. In reply to the questions of the several speakers, Mr. Lozier stated that a plot of ground 50 ft. x 100 ft. is amply sufficient to contain a 1000-kw gas engine sub-station. As to whether a gas engine sub-station is more economical than electrical transmission to a rotary sub-station will depend upon local conditions. It is noteworthy, however, that the price of a two-mile cable to supply 6000 kilowatts will cost about $80,000. The heat units can be taken from the coal more efficiently with a gas producer than with a steam boiler. There are no by-products from a gas producer plant. Water gas is one of the best fuel gases known, but it cannot be used in gas engines because of the high content of hydrogen. Carburetted water gas, however, is extensively used.

Mr. E. H. Davis, chairman of the committee on freight classification, made a report favoring a universal classification ap-

plicable over the whole country. This report was adopted.

Mr. W. L. R. Emmet presented his paper on "Recent Turbine Developments," an abstract of which follows.

CURTIS STEAM TURBINES.

In the paper Mr. Emmet showed the progress that had been made in the development of Curtis turbines. In this development the objects sought have been as follows: High steam economy; the use of a small number of rugged parts; the elimination of all small clearances; the economic recovery of the large energy available in high vacuum, and the production of flat load-efficiency curves. He reported the result of tests on turbines rated at from 1000 to 9000 kilowatts. These turbines showed at full load under normal operating conditions the following values of steam consumption in pounds per kw-hour: 1000 kilowatts, 16.9 lbs.; 2250 kilowatts, 16.3 lbs.; 5000 kilowatts, 13.5 lbs.; 9000 kilowatts, 12.9 lbs. The last-mentioned value relates to one of four 9000-kw units which have been installed in the Fisk Street station of the Commonwealth Electric Company of Chicago. At a load of 13,900 kilowatts, this machine showed a steam consumption of 13.6 lbs. per kw-hour, while at a load of 5375 kilowatts the consumption was 13.15 lbs.

He explained that in the development of the vertical shaft steam turbine the most serious troubles have arisen from unexpected tendencies to vibration in certain particular designs. The balanced condition of a vertical machine is peculiar, and certain conditions must be conformed to in order that steady running may be obtained. Certain machines that have given trouble in this respect have been sent out in considerable numbers and in many cases it has been impossible to afford immediate relief for the trouble. Generally speaking, however, the vertical type has shown itself to be wonderfully dependable and free from many of the difficulties which endanger the operation of other kinds of machinery.

In reply to questions by Messrs. Mason Kemble, Richards, Bibbins, Bullock, Josselyn, Sands and Manning, Mr. Emmet said that in order to obtain a high degree of vacuum virtually no additional condenser is required. The pressure of the atmosphere does not affect the economy of the machine; when the pressure is low the pump requires less power. The steam consumed by the auxiliaries is usually employed for heating the feed water; the economy can be increased considerably by taking steam from the middle of the turbine so as to raise the feed water temperature. A 250-kw condensing turbine equipment consumes about 23 lbs. of steam per kw-hour, which value is less than is found with a steam engine of similar rating. In a 500-kw four-stage turbine using saturated steam, the consumption is 19.5 lbs. per kw-hour at full load. The coal consumption depends upon many factors external to the turbine. In the Chicago station the 9000-kw turbines use about 1.8 lbs. of good coal per kw-hour. It is possible, however, under improved conditions to reduce the coal consumption to 1.5 lbs. per kw-hour. The use of 225 degrees of super-heat may reduce the steam consumption by 16 per cent, but the cost of producing the superheat will reduce the gain to probably 4 per cent.

Mr. Budd Frankenfield gave in abstract his paper on "Balancers Versus Three-Wire Dynamos," an abstract of which follows.

BALANCERS VERSUS THREE-WIRE DYNAMOS.

Mr. Frankenfield described a few types of three-wire dynamos that have been placed on the market, and compared them with the dynamo-electric form of balancer. The three-wire dynamos dealt with were the Hopkinson double-commutator machine, the Dobrowolsky auto-transformer dynamo, the Lamme double auto-transformer machine, the Osana auxiliary winding three-wire dynamo, and the salient-pole three-wire machine of Dettmore and Rothert. The forms of balancers described were divided into three classes: First, balancers that give equal voltages only on balanced loads; second, balancers that may be regulated manually to equalize the voltages, and third, balancers that regulate inherently for equal voltages under condition of load. After discussing each of these in detail, the author arrived at the following conclusions:

1. The three-wire dynamo cannot be regulated for equal voltages; the balancer can.

2. The balancer can also be made to regulate inherently for equal voltages; the three-wire dynamo cannot.

3. The balancer is capable of carrying a neutral overload with good regulation; the three-wire dynamo can carry it, but only with poor regulation.

4. The three-wire dynamo represents extreme specialization in design. This means long delivery when in a hurry to increase the size of plant. It means delay when it becomes necessary to make repairs. The two-wire plant with a balancer consists of standard apparatus throughout. This means quick delivery and quick repairs.

5. The three-wire dynamo has complicated connections repeated for each unit in the plant; this makes it difficult to locate trouble. The connections of a two-wire plant using a balancer are simple and easy to understand. Trouble is easily located.

6. The three-wire dynamo requires expensive switchboard connections and a lot of heavy cables. The two-wire plant with balancer does not.

7. A two-wire dynamo will not operate successfully in parallel with a three-wire dynamo without remodeling. Any number of two-wire dynamos can be added to a two-wire plant with balancer without making a single change in their construction.

8. There is danger of a violent short-circuit when a three-wire dynamo is brought up to speed and paralleled. This danger does not exist in equalizing a two-wire dynamo or in equalizing a balancer.

9. A three-wire dynamo requires two double-pole circuit-breakers. The two-wire dynamo requires but one. The balancer requires but one.

10. The three-wire dynamo plant requires two equalizers. The two-wire plant requires one, and when compound balancers are operated in multiple the equalizer outlay for this portion of the plant is insignificant.

11. The three-wire dynamo plant requires two ammeters for each machine. The two-wire plant with balancer requires but one ammeter for each machine and one for the balancer.

12. The balancer can be located at a distance from the station. The three-wire dynamo must reach out from the station to the distant point.

13. Lastly, it should be emphasized that the balancer is not limited to isolated-plant service, but is capable of much heavier duty.

Dr. Edward P. Hyde read a paper by himself and Mr. F. E. Cady on "The Effect of Frosting Incandescent Lamps." This paper took up an analysis of the reasons for the shortening of the life of incandescent lamps by frosting, which have already been published in a bulletin of the Bureau of Standards and discussed at length in articles in THE ELECTRICAL WORLD of April 20 and May 18, 1907.

A paper by Miss S. M. Sheridan, of Detroit, on "Some Power Experiences" was read for Miss Sheridan by Mr. Alexander Dow. An abstract of this follows.

EXPERIENCE WITH ELECTRIC EQUIPMENTS.

Miss Sheridan in her paper related the experience of a certain central station company with various types of electrical apparatus. With large blowers it is frequently found that the fans deliver more air than is actually required. In displacing a certain steam installation it was discovered that a smaller pressure was sufficient for the work, and by reducing the speed of the fan a customer's bill was reduced by about $15 per month. In another instance the pressure at the blower was reduced by one ounce by shortening the length of the pipe by 100 ft., thus reducing the load by six horse-power. In a small machine shop the friction loss was reduced by changing the location and piping of an air compressor so that the intermittent small loss in an air pipe was substituted for a constant considerably less in the friction of a shaft. In one small factory it was discovered that the bearings in an air compressor were running on the iron of the boxes. Proper babbitting of the machines reduced the customer's demand by two kilowatts, and the

central station company retained the business. The company has taken special pains to assist customers in keeping down constant losses, such as friction and energy, and it readily offers a reduction of the standing charge-item of the price in consideration of a customer undertaking to refrain from using specific parts of his equipment during the hours of the winter lighting load.

The session then adjourned.

THURSDAY EVENING'S SESSION.

On Thursday evening Mr. H. H. Rice presented his paper entitled "The Electric Automobile as an Adjunct to Central Station Loads." An abstract of this follows.

THE ELECTRIC AUTOMOBILE AS AN ADJUNCT TO CENTRAL STATION LOADS.

The paper of Mr. Rice dealt with the opportunities for the sale of energy for charging electric automobiles and gave a most convincing argument for the co-operation of central station companies and electric vehicle owners. He stated that an electric carriage will use more energy in a day than most signs in a week, a fan in a month, a hot water bag in a year, or a curling iron in five years, and yet many dollars are spent in soliciting for and advertising the latter things and with few exceptions scarcely a cent is spent for the electric vehicle. In all probability many companies are making considerable profit out of signs, yet signs use electricity during the peak of the load. Electric carriages, however, do not ordinarily take electricity at that time and restrictions are unnecessary in most cases. In general, there are two classes of electric vehicle owners—those who leave their carriages at the garage to be charged during business hours, and those who use their carriages during the day and evening and have them charged at night. Thus without contracts, the charging is done mainly off the peak, but if desired contracts may be so worded as to prevent a charging load from being taken during the peak hours. The Edison Electric Illuminating Company of Detroit furnishes energy to private users of electric automobiles at 5 cents per kw-hour, allowing in some cases a 10 per cent discount. To public garages it makes a rate of 3 cents in accordance with its order-form. In each case it is stipulated that charging shall not be done during the time of the evening peak. The company has no way except by occasional inspection of telling how this stipulation is lived up to, but it is believed that the requirements are fairly well observed.

Recently there has been a marked change on the part of certain central stations towards electric vehicles. The New York Edison Company states that it has in constant use for business purposes 57 electric vehicles. The Electric Light Company at Hartford has for years used electric vehicles and has run its own garage as it would its own stable. The Union Electric Light & Power Company of St. Louis, Mo., has begun a vigorous campaign to encourage the use of electric automobiles. This company has opened a garage in the residence district for electric automobile service, where it provides an expert battery man. Its charges are from $30 to $35 per month, which includes storing, washing and delivery. As a result of the campaign the sale of electric automobiles in St. Louis is booming.

Similar reports come from other localities in which central station companies have openly shown their interest towards encouraging the sale of electric vehicles. The Edison Company of Rockford, Ill., has successfully handled this part of its business for the past two or three years. In this city a few electric wagons are kept in public garages, but most of them are placed in private garages in the residence districts. The last report showed that 75 electric wagons were cared for by the owners. Among the other lighting and power companies that have been instrumental in selling electric automobiles in their territory may be mentioned the following: The Freeport Street Railway & Power Company, Freeport, Ill.; Birmingham Railway, Light & Power Company, Birmingham, Ala.; Little Rock Street Railway, Light & Power Company, Little Rock, Ark.; Springfield Light & Power Company, Springfield, Mo.; McMeen Light & Power Company, Galesburg, Ill.; Michigan City Light & Power Company, Michigan City, Ind., and South Shore Gas & Electric Company, Hammond, Ind.

A plan is on foot at the present time to be applied by at least a half-dozen central stations in New England wherein the lighting companies will send a circular to each physician in their respective cities, notifying him that they are prepared to give him a practical demonstration of the utility of the electric vehicle in his service and are prepared to place at his disposal an electric vehicle with a driver to take him over his day's route to visit his patients, so that he may be satisfied as to the practicability of the outfit as applied to his own use.

As is well known, there are numerous electric cabs in use in New York City, and many new electric vehicles were placed in service during the last two years. It is worthy of note also that the city of Cleveland has over 800 electric carriages in use and Chicago more than 1000. The sale of electric automobiles is not necessarily confined to level cities. As a matter of fact, electric carriages are sold and successfully used in hilly cities like Pittsburg, Providence and Kansas City. The fact should not be overlooked that hills which are severe for automobiles are still more severe for horses.

As to the rates charged, these vary with every locality, but it is apparent that at least relatively low rates can be quoted with profit. Rates of 2, 2.5, 3 and 4 cents per kw-hour to garages are reported by central stations as giving satisfactory profit. To individual users rates of from 5 to 7 cents flat, and 10 cents per kw-hour, with certain quantity discounts, are quoted. In some places, however, rates are prohibitive. The author suggested that central stations should quote favorable rates for electric vehicles and thereby encourage the sale of energy, especially off the peak. The amount of energy required to charge a carriage varies considerably, but at the rate of 5 cents per kw-hour, for example, the income from individual customers averages about $6 per month, or, say from $50 to $75 per year for small carriages used for pleasure or errands. Garages with 30 vehicles have bills ranging from $200 to $300 per month when the rate is from 3 to 4 cents per kw-hour.

The mercury arc rectifier is the simplest and cheapest device known for charging electric automobiles from alternating current supply. It is particularly well adapted for use in private garages, where only a single vehicle is to be charged at a time. In Indianapolis fully 20 have been put in service within a year and favorable reports have been received from their owners.

In concluding, the author stated that the interests of the electric automobile manufacturer and the central station company are mutual. The manufacturer sells the car, while the central station sells the energy. The central station by its own example and encouragement should push the sale of electric vehicles and thereby increase the sale of energy. Those officers and managers of central stations who use horses instead of electric runabouts, and employ horse-drawn wagons instead of electric trucks, by comparison are like an electric light company that burns gas for its own lighting. Beyond all doubt the electric vehicles are cheaper and better than the horse-drawn vehicles. They require merely that in connection with them there be used the same degree of intelligence as with any other electrical apparatus.

RECOMMENDATIONS ON GROUNDING.

The report of the committee on the grounding of alternating-current secondary circuits was presented by Mr. W. H. Blood, Jr. The essence of this report was that it recommended that the grounding of alternating-current secondary circuits, where less than 150 volts would exist between conductors and ground, be made mandatory; this grounding wherever possible to be made to water pipes. Quotations from a number of eminent authorities were made endorsing such action. As to the methods of grounding where water pipes are not available, the committee was not ready to make recommendations and suggested that this would be a good subject for discussion in the convention

and during the coming year. It was not prepared to recommend the grounding of circuits of higher voltages until the rules surrounding such grounds be better formulated than at present.

ASSOCIATION TAKES STAND ON ATTITUDE TOWARD STATE REGULATION.

The remainder of the evening session was given over to a discussion of the report of the public policy committee and several sub-committees discussing different aspects of this subject. After a lengthy discussion the report of the public policy committee was adopted as expressing the sense of the association and it was ordered printed for general circulation. An abstract of this report will appear later. It expresses approval of proper laws for the regulation of electric light and power companies by state commissions and by franchises so drawn that the regulation is somewhat automatic in its character by reducing rates in proportion to increase in dividends, as in the London sliding scale.

During this session General George H. Harries, president of the Potomac Electric Power Company, who was most active in looking after the entertainment of the convention, interrupted President Williams in the conduct of the meeting to present him with a gavel made from the wood of one of the Senate Chamber doors of the old original Capitol building. This gavel was presented by the exhibitors. It bore the certificate of Mr. Elliott Woods, superintendent of the United States Capitol and grounds, as to the genuineness of the wood.

FRIDAY MORNING'S SESSION.

On Friday morning the paper by Signor Semenza entitled "Italian Methods of Charging for Electric Service" was presented in abstract by Mr. L. A. Ferguson. An abstract of this paper follows.

ITALIAN METHODS OF CHARGING FOR ELECTRIC SERVICE.

The first part of the paper gives data concerning the rates charged in Italy for electrical energy for motor purposes. The Lombard Company for the Distribution of Electrical Energy supplies power at 3600 volts at rates per annum and for 12 hours use per day, varying from $40 for from 100 to 150 kilowatts to $36 above 700 kilowatts. Another power transmission company has a sliding scale of rates varying per kw-annum and 24 hours daily use from $58 for 10 kilowatts to $50 for 50 kilowatts. The rates of the Ferrari-Galliera Company are $108 per kw-annum, 24 hours daily use, for 5 kilowatts to $50 for over 100 kilowatts. At Rome the rate is $40 per kw-annum for 24 hours daily use for quantities above 10 kilowatts. In Milan a meter system conjointly with a Wright maximum demand system was adopted. There is an initial rate for 83 hours use per month; a second rate up to 125 kw-hours use; a third rate up to 166 hours; a fourth rate up to 208 hours; a fifth rate up to 250 hours, and a sixth rate above 250 hours. For example, if a customer has used 3000 kw-hours in a month, with a maximum demand of 10 kilowatts, the bill will be a summation of the following quantities: 830 kw-hours at 4.25 cents; 420 kw-hours at 3.36 cents; 410 kw-hours at 2.76 cents; 420 kw-hours at 2.16 cents; 420 kw-hours at 1.56 cents, and 500 kw-hours at .5 cents, making a total of $78.79, or an average of 2.62 cents per kw-hour.

Mr. Semenza then proceeds to give the details of a proposed system of his own, which he calls the double sliding-scale method. This is applied by installing with the customer a volt-ampere meter and a maximum-demand indicator, the readings of which are taken at periods corresponding to the billing periods. The bills are made up in the following manner: 1. By charging a fixed rate, *A*, for each kilovolt ampere maximum demand. 2. By charging a fixed rate, *B*, for each kilowatt hour. 3. By multiplying the sum of the above two items by a coefficient, *C*, taken from a special coefficient curve, preferably plotted from a simple formula, the deduction of which is given in the paper, and which is worked out in accordance with local conditions, cost of energy and all the ordinary items which are to be taken into consideration in planning any method of charging.

Following this Mr. Ferguson also gave a brief talk on the subject of:

A NEED FOR AN ACCURATE MAXIMUM DEMAND METER FOR MEASURING THE TRUE VALUE OF POLYPHASE SERVICE.

He stated that in Chicago they had practically found it out of the question to use the Wright demand meter for measuring current rather than actual power, and if unity power factor was assumed it would make the customer's apparent maximum too high. They had determined the ratio of the maximum demand to the connected load on 10,000 horse-power of direct-current motors connected to their service, and by making several classifications had arrived at a maximum demand to be assumed for alternating-current motors.

Where a customer has one motor, the ratio between maximum load and connected load is higher than where there is more than one motor installed. If a man has 50 1-hp motors they would not all be used at once, whereas if he has only one 50-hp motor he is using it all the time. He found it was better to make the classification according to the horse-power. This tends to take into consideration the difference between groups of motors and installations of one motor. Following is the classification under which they are working: Class A, installations up to 10 horse-power, where one motor is used, 85 per cent of the connected load is assumed to be the maximum demand; where more than one motor is used, 75 per cent of the connected load. Class B installations, from 10 to 50 horse-power, irrespective of number of motors, 65 per cent of the connected load. Class C installations, all over 50 horse-power, irrespective of the number of motors, 55 per cent of the connected load.

Mr. Junkersfeld said that the distribution of energy depends very much on the power factor, while the generation of energy does not. In Chicago it has been found that there is considerable difference between the Wright demand meter readings on different legs of the same circuit. In measuring the maximum demand of large railway systems it is proper to take the reading of a calibrated watt-hour meter for one hour and assume this to be the fair maximum demand in kilowatts. For smaller installations the time-clock attachment can be put on an ordinary watt-hour meter to measure the output for 15 minutes, or whatever length of time was assumed to be correct, the maximum being taken as an average demand for 15 minutes.

After considerable more discussion by various members, Mr. Ferguson said that there is evidently now no question but that there is need for a cheap demand meter for use on all motor customers. For large motor customers the demand has been met by the watt-hour meter with time-clock attachment.

Mr. H. T. Sands said that his company is accustomed to forget power factor and take 75 per cent of the recorded maximum kilovolt amperes; or, in other words, to assume that the power factor at maximum demand is 75 per cent.

At the close of this discussion on maximum demand meters it was voted to appoint a committee on meters to consider the subject for another year. The chair appointed as such a committee Mr. L. A. Ferguson, of Chicago; Mr. Alexander Dow, of Detroit, and Mr. J. E. Montague, of Niagara Falls.

PROTECTION FROM LIGHTNING.

The Committee on Protection from Lightning, consisting of Mr. Alexander Dow, as chairman, and Messrs. O. H. Honnold and Robert S. Stewart, submitted a report recording and analyzing the damage done by lightning during 1906. It was found that there had been considerably more trouble during 1906 than 1905. Approximately half of the companies from whom reports had been received suffered the burning out of transformers or generators. The transformers damaged were largely of the small old air-cooled type. Current transformers, especially those on high voltage lines, have burned out frequently. Of the companies that have reported transformer losses, one-half have lost less than 1.4 per cent of their transformers. Some, however, have been especially unfortunate, losing over 5 per cent during the year. The committee stated that in the present state of the art good practice should keep the destruction of

transformers by lightning down to or below 1 per cent of the number connected. Most of the meters burned out were on direct-current lines. One company having approximately 2400 meters connected to an overhead direct-current network reports that it has been exempt from troubles of this kind for the past two years, because of its installation of choke coils on each service where a meter shunt had previously been burned by lightning. When these coils were installed on the service wires a pair of lightning arresters was placed on the line at the next pole to provide a discharge point for the lightning, which previously found its way through the meter shunt. The plan is inexpensive and it appears to be trustworthy.

Very little was learned in regard to the experience of companies with overhead ground wires. Only 18 had had experiences with such wires during the lightning season, and eight of these were not satisfied. One company has operated a 16,000-volt line more than 20 miles long with three barbed wires above the transmission line; during eight years no pole has been struck and no insulators have been broken. One company that installed the overhead ground wires last season has noted from its test papers in the ground connections that the discharges to earth from the overhead ground wire are very frequent. The committee concluded that the overhead ground wires are of undoubted benefit where they are installed so as to be mechanically strong. The advisability of using then hinges largely on the question of cost. The committee also stated that lightning arresters are necessary on all circuits and should be installed on distribution circuits wherever there is apparatus to be protected, because violent discharges prefer to jump large air-gaps rather than to travel from 600 ft. to 700 ft. to the nearest arrester. The practice calls for arresters at each transformer and at the ends of branch lines. The multi-gap arrester still remains the standard arrester for alternating currents. It is now built with part of the gaps shunted with permanent resistance, and in some cases with a fuse wire.

COMMERCIAL DEVELOPMENT OF THE MERCURY ARC RECTIFIER.

A paper by Mr. Frank Conrad outlined the recent development of the mercury arc rectifier as used by central stations. He gave a description of an outfit designed primarily for the operation of the new high-efficiency arc lamps. Use is made of a regulating transformer similar in general to that employed for alternating current lamps, the secondary, however, is wound for the higher voltage required on the rectifier terminals, a middle tap being furnished for the negative terminal of the direct current circuit and in addition to this some extra taps are placed near the ends of the secondary winding to provide for operation on loads below the rated capacity and at a power factor corresponding to that obtained on full load. An auxiliary secondary winding, consisting of a few turns, placed directly on the transformer core, is used for operating the starting device of the bulb. For starting two methods have been employed. In one of these methods two additional electrodes are used in the bulbs. These auxiliary electrodes are connected to a small transformer, which is fed from the auxiliary secondary on the main regulating transformer, and connection is made from the negative electrode of the bulb to the middle point of this small transformer, the whole thus constituting a complete rectifying outfit on a smaller scale. The auxiliary electrodes are so placed that by tilting the bulb the mercury forming the cathode will bridge over and short circuit them, the spark that follows the breaking of this short circuit serving to start the operation of the rectifier.

The bulb is mounted in a wooden cage and placed in the tank that contains the regulating transformer and auxiliary apparatus. The external appearance of the completed device is similar to that of the oil-cooled regulating transformer used for series alternating-current lamps. Connections are made from the bulb to contacts on the bottom of the wooden cage, which contacts in turn register with the set attached to the framework of the regulator. When the cage is lifted out of the oil for inspection or renewal of the bulb, all connections are automatically broken, and when the cage is replaced the connections are automatically made. The placing of all of the parts together in a single tank has a number of advantages, among which may be mentioned the following: There is no exposed high-tension wiring to collect dust and, through leakage, to affect the operation of the rectifier bulb, it having been found by experience that a very slight leakage from the connecting wires between the rectifier bulb, the reactance and the transformer very greatly increases the tendency of the bulb to short circuit or to go out. The bulb is protected from any chance of accidental injury. The life of the bulb is very greatly increased, due principally to the cooling effect of the oil, which is a very vital point. When the bulb is immersed in oil having a comparatively large radiating surface the temperature is kept low, and by this means it is possible to use a construction that will give a minimum of loss and still be free from any tendency to short circuit.

Tests that have been made show that the average life of a bulb that is operated in air is about 700 hours. When the bulb is operated in oil there is apparently no depreciation whatever, the life depending somewhat on accidental circumstances, and it averages several thousand hours.

NEW BUSINESS DAY.

Following are abstracts of most of the papers and discussions which were presented on the New Business Day programme. During the presentation of these papers Mr. W. W. Freeman, of Brooklyn, chairman of the committee to assist in the further development and prosecution of the plans of the Co-operative Electrical Development Association, presided. Mr. J. Robert Crouse, who did a great deal of active work in the drawing up of the Commercial Day programme, and who represented the Co-operative Electrical Development Association, also occupied the platform. The papers on the Commercial Day programme were bound together in a booklet, which one of the enthusiastic commercial men afterwards declared was in itself a good solicitor's handbook.

Mr. J. Robert Crouse introduced the subject with his paper on "Co-operative Commercialism in the Electrical Field," which he read only in abstract.

PLANS OF CO-OPERATIVE ASSOCIATION.

The complete paper gives the plans of the Co-operative Electrical Development Association, and also its constitution and by-laws. Among the more specific and tangible plans outlined in this paper under the head of "Detail Plans" are the following: A representative in the field would call upon lighting companies, jobbers and contractors in cities of 100,000 population and over for the double purpose of giving and receiving information about the latest selling means and methods. He can arrange for the interchange of expert solicitors from one company to another. Another representative would follow along the same lines of activity in cities of from 100,000 to 10,000. He would also have assistants. Twelve representatives would work along the same general lines, but in cities under 10,000 inhabitants. An arrangement is made in the plans also for a corps of expert solicitors for assisting central stations or contractors in starting commercial departments. A representative would also travel among electrical contractors, co-operating with them along lines which might be expected to result in increased business. Provision is made for a representative to work among the architects. He would make it a point to get in touch with the national, state and city associations of the architects and contractors with the object of presenting before them papers dealing with the subject and emphasizing the very great present and prospective utility of electric service in light, heat and power. Commercial literature will be issued to the electrical trade somewhat as in the past, with the idea of arousing interest in progressive commercialism by central station companies where the earnings per capita are at present very low. Commercial literature will also be issued to architects, builders, contractors and real-estate dealers to secure wiring of new buildings, because thousands of possible customers are at the present time lost because of properties not having been wired during the last ten years. The report closes with a summary of the results of the new business movement up to December, 1906.

COMMITTEE REPORT FAVORS CENTRAL STATION MEMBERSHIP IN ASSOCIATION.

The convention listened to the report of the committee to assist in the further development and prosecution of the plans of the Co-operative Electrical Development Association, this committee consisting of Messrs. W. W. Freeman, of Brooklyn; John F. Gilchrist, of Chicago; R. S. Hale, of Boston; J. E. Montague, of Niagara Falls, and F. M. Tate, of Dayton, Ohio. The committee first quoted from the report of a similar committee of the year previous to the effect that the financial obligation of the work at that time rested upon the manufacturers. The present committee, each member of which has attended every meeting, is unanimous in the belief that the time has come for the members of the association to give more than moral support to the plan, and, in fact, to participate with the manufacturers on an equal percentage basis of expense and a corresponding equal control over the direction of the movement. Companies withholding their support would, of course, enjoy the benefits of the movement equally with those who would bear the cost, but such a movement, if inaugurated by the more progressive manufacturing and illuminating companies, would, within reasonable time, be supported by practically all. In general this movement would constitute a clearing house for ideas and methods and an effective publicity bureau for the popularization of the use of electricity for all practical purposes. The proposed membership subscription is approximately one-tenth of one per cent of the revenue derived from sale of electrical or related apparatus or of electric energy. As most of the member companies are to-day spending from 2 to 5 per cent of their gross income in publicity and solicitation, only a small percentage of the expenditure of the company for obtaining new business need be subscribed to the Co-operative Association. The committee thinks such expenditure would pay the central station. For the foregoing reasons the committee arranged that the proposed by-laws of the Co-operative Electrical Development Association should admit illuminating companies to equal membership and rights with manufacturers.

MR. DOHERTY'S PREDICTIONS VERIFIED.

Mr. Henry L. Doherty in a paper on "The Possibilities of Commercial Development" quoted extracts from his presidential address to the N. E. L. A. at Cincinnati in 1902 in which he forecasted the present great commercial and new business awakening on the part of central station companies. In another public address some years ago he also predicted that the progressive merchant would display as lavish lighting as was then characteristic of the national industrial expositions. This had proved nearly true, yet no one had reached the point where further lavishness in lighting would not pay. We used to talk about the point of saturation, meaning that time when we should have disposed of all of the electricity that could be sold in a given city. If there is such a thing as the saturation limit, we have not yet found it. They are now taking on business in some of the central stations with which Mr. Doherty is connected at a greater ratio each year than the entire business of the central station when he first became interested in the subject of development of the market.

NEW BUSINESS: HOW TO GET IT; HOW TO KEEP IT.

Under the above head Mr. Frank M. Tait, of Dayton, outlines general methods and also gives some specific data of a rather startling character. After mention of the card index system for keeping lists of prospects, he takes up the solicitor and expresses the opinion that this business offers an excellent field for bright, active young men. Every central station should provide a library and have on file various electrical papers, that the young men in the various departments may qualify themselves theoretically as well as practically for the position of experts on the new business force. Solicitors should fill out records of their daily operations. The company to fortify the solicitors should promptly follow up complaints. Advertising in local newspapers and a follow-up system of circulars and letters is advocated. Every electric light company should install one or more attractive electric signs and turn them on every night. Illuminated bill boards can likewise be used. Sign outline and window lighting should be vigorously canvassed. Every progressive lighting company should have a display room and it should be kept in first-class and attractive shape. The following figures will serve to illustrate what may be done when the right spirit is aroused: In a town of 10,000 inhabitants in the far west a company about a year ago started to make up an aggressive new business scheme, and it reports for the first two weeks in April of this year it has secured the following new business: Wired 100 old houses; sold and installed 25 lamp signs; sold 250 flat-irons; installed 8 coffee percolators; installed 120 horse-power in motors. It is estimated that this new business will return an annual gross revenue of $10,000 and that $1,200 was spent to secure it in personal solicitation, advertising and circular letters Mr. Tait closed with this vigorous appeal:

"Those companies that have not yet installed new-business departments or taken up the matter aggressively, those that have taken it up in a half-hearted, dreary manner, those that have a pet theory that their respective methods of obtaining new business are the best, should keep before their mind's eye the excellent results obtained by the little village in Ohio of 1400 people where progressive new-business-getting of the most pronounced type has produced a revenue of $8.50 *per capita* and still increasing, and this in the fact of competition from a good supply of natural gas in the village, at 25 cents per 1000 cu. ft. Any central station man who has made it a point to learn the *per capita* yearly income that is obtained to-day by the various large companies, as well as by many average and small companies, will thoroughly appreciate what $8.50 *per capita* means.

"Think of it—small companies, medium companies, large companies—$8.50 per year for every man, woman and child, and then let us go home from this convention and decide that we will all take a new hold on the commercial end of the various companies and strive to emulate our small contemporary who accomplished these wonderful results by simply keeping after it! Let us go after the new business energetically, and when we obtain it, carefully husband it and enlarge it, and use every possible addition to our gross receipts as a stepping-stone for more and better results. Any company can do it, anywhere. Analyze your local conditions and then go after it. Be aggressive commercially. It pays."

New business departments properly manned can produce load curves that will show that, while the peak may be increased 10 to 15 per cent, the average load off the peak is raised 30 to 50 per cent, provided the new business men go after the revenue producing and economical kind of business.

NEW BUSINESS RESULTS DEMONSTRATED IN CITIES OF ALL SIZES.

Mr. J. E. Montague mentioned the fact that, whereas $2.50 per capita income from the sale of electric energy is the average, according to the last census, the per capita sales have been and can be increased to from $5 to $8.50, and even $12 per capita. The results of the commercial departments of many central stations indicate that the per capita incomes of such stations rapidly pass the average of those where a live interest is not taken in the commercial development. Expenditures of from 3 to 5 per cent of the gross income on business extension is fully justified. The load curve may be materially improved, and in consequence the ratio of gross income to operating expense. Most of this very interesting report is taken up with statistics showing new business results in town of various sizes, which the author wishes to see made a feature of future commercial programmes. Some of these statistics will be published in a later issue. They show gross incomes per kilowatt of maximum station capacity all the way from $10 to $119, and gross incomes per capita of population of from $2 to $8.50.

SALES POLICY OF A COMBINATION GAS AND ELECTRIC COMPANY.

Mr. F. A. Willard outlines the policy which he thinks should be followed by such a company. Rates are made such that all short-hour business will go to gas and all long-hour business to electricity. Electric rates are made up on a load factor basis. Electric appliances should be sold and installed by the company,

but electrical contractors in the same community should be protected and encouraged by selling appliances at what would be a fair profit to the electrical contractor. A wiring department should be maintained by the company with the same policy toward contractors. The company cannot afford to leave the electric iron to contractors. An electric company could afford to give irons away, but could probably put out as many at $3.50 each as if it gave them away. Outside of the electric iron the heating business should be awarded to gas. As to the policy of throwing short-hour business to gas and long-hour to electricity, he gives figures showing that the operating expense of the electric plant is divided about as follows: Generating expense, 25 per cent; distribution expense, 36 per cent, and general expense, 39 per cent. While for gas, cost of gas in holder is 54 per cent; cost of distribution, 9.14 per cent, and general expense, 36.6 per cent. By putting both gas and electricity in a house a larger revenue will be obtained from each than if only one service was allowed. To verify this he selected several streets at random in Rochester. Of 32 residence customers during the year 1904, bill averaged $4 each using gas service only. During 1905 with electric service in and combination fixtures the gas bills averaged $2.89 and the electric bills averaged $3.84, making the total average revenue from each consumer $6.73, or an increased revenue of 68 per cent. The possibility of turning more long-hour business over to the electric end has been made easier by recent improvements in electric incandescent lamps. He gives the cost of a 48-cp Welsbach gas lamp, burning 4 cu. ft. of gas per hour, at $1 per 1000 cu. ft., as 4 mills, and that of a tungsten lamp of 50-cp, consuming 62.5 watts at 10 cents per kw-hour, as 6.25 mills.

CO-OPERATION OF THE ELECTRICAL TRADE PAPERS.

Mr. F. W. Loomis reviewed some of the work done by the electrical trade papers the past year in spreading information as to successful prosecution of commercial work in different cities. It urges more co-operation on the part of different companies with the technical press in furnishing for publication information which will be of assistance to other companies.

HOW TO GET THE OLD BUILDINGS WIRED.

Mr. F. H. Golding, in a paper having the above title stated that service should be given to any installation, no matter how small. A preliminary house to house canvass of the residence district should be made to learn the situation so that the salesman can work intelligently. He should concentrate his efforts on the most favorable prospects, endeavoring to have not less than one or two on each block. If the subscriber will not light his entire premises, endeavor should be made to install a cellar or porch lamp, electric iron, sewing machine motor, or any other appliance that will appeal most to the prospect. Liberal use of small electric signs and illuminated bill-boards through the residence districts is valuable. Arrangements can be made with store or shopkeepers by making a concession in their lighting rates for the location of signs on their buildings and switching them on and off. The company should be prepared where conditions seem to warrant to offer a proposition whereby wires and fixtures may be paid for in weekly, monthly or quarterly installments. If the central station does not do interior wiring a satisfactory arrangement could be made with the electrical contractors whereby the latter would add, say, 10 per cent for interest and the expense of carrying the account.

HOW TO GET NEW BUILDINGS WIRED.

Mr. J. Sheldon Cartwright said that, as a rule, building syndicates and owners place confidence in some firm of architects. To the architect then your central station solicitor should turn and make his arguments as to the advantages of having the proposed building wired. He should offer to assist in the layout of circuits so that the best conditions can be realized. He should supply the architect with necessary literature and data on various electrical appliances, and should keep up a persistent but not obnoxious hammering until he has gained his point. People are sometimes more inclined to listen to the arguments of wiring contractors than to those of a central station solicitor, and the contractor's influence should be used. If the customer still holds out, try to get him into your showroom. After that if he still refuses, call in the salesmen of the elevator companies, fixture companies, electrical office devices and heating, cooking and ventilating devices. In houses which are built for the owner's residence a well posted lady solicitor can accomplish in a great many instances more than a man. It would be advantageous for the larger companies to have at least one lady who is not only a good talker and demonstrator, but who has had practical every-day experience with the sewing machine motor, electric flatiron, the heating pad and various electrical heating and cooking utensils. If a family has once had the conveniences and comforts of an electric installation it is very rare that it will move into a building in which one is obliged to hunt around for a match every time a light is wanted, and as for buying a building or home that is not wired, they will stand for almost any other omission without fault-finding, but not for the lack of wiring. The various visits of your solicitor should be interspersed with some judicious advertising. By this is not meant large bulletins with "art gallery covers" and miscellaneous contents, but rather the small pamphlet form with short, pithy arguments covering the particular result you are trying to accomplish.

CO-OPERATION OF THE CONTRACTOR.

Mr. James R. Strong, president of the National Electrical Contractors' Association, stated that the contractor is usually too busy supervising work in hand to spend much time in solicitation. As to standardizing work and materials, it seemed to him that nothing is of greater importance to this movement for extending the electrical business than that the trouble breeding flexible cord installations and their like should be relegated to oblivion. Extensions should be made of such permanent and substantial character as will tend to place the electrical business on a more firm and wholesome basis in the eyes of the public. The contractor and his organization have been co-operating for a long time along the lines of standardization in several ways; with the underwriters for the improvement and simplification of the National Code and its uniform interpretation; with the manufacturers for the standardization of various fittings and appliances; with various legislatures for the standardization of work by licensing and bonding the contractor; with the architects for the introduction of uniform symbols for wiring plans. The uniform symbols adopted by the National Electrical Contractors' Association were on May 20 also adopted by the American Institute of Architects with two minor alterations. He pointed out very strongly that the jobber and contractor cannot look with favor on any proposition to boom the business of a lighting company which involves selling thousands of fans at manufacturers' prices, purchasing supplies from the manufacturer, and employing 100 or more men in wiring buildings for cost or less.

QUALIFICATIONS OF SOLICITORS FOR DIFFERENT CLASSES OF BUSINESS.

Under this head Mr. Frank W. Freauauff classified and described the qualifications of solicitors needed. Solicitors should develop into specialists as the importance of their particular work and the distinction between classes of business become more apparent. A consumer prefers to feel that he is being approached by some one specially fitted to advise him on the proposition he is considering. For electric motor solicitation a man should have techincal knowledge of steam and electrical engineering. Many of the best prospects for the electric company lie in closing down isolated plants. He must be able to figure the amount of coal used under present conditions and the saving if the lighting load is taken off. A solicitor understanding only the selling end of the business can make little headway in securing motor contracts. He should be able to analyze local conditions and determine the probable load factor and to determine the cost of past operation and probable saving through a change to the central station. A specialist on sign and display work must be essentially an advertising solicitor. He must keep abreast of the latest advertising methods and the work being done in other cities, in order that he may be

able to present new methods of display. A display made for one merchant in a given line of business is impossible for another. A great deal of business can be secured from merchants in the same line if a variety of suggestions can be given. For window lighting many of the qualifications of a sign and display lighting solicitor are required, plus a good knowledge of decorative lighting and illuminating engineering. A solicitor working on interior lighting is best qualified if he has a complete knowledge of illuminating engineering, thus knowing how to secure the best effects with the least outlay to the consumer. A solicitor without this training can accomplish little permanent result. The solicitor working among builders and architects must be acquainted with all the latest devices for wiring and equipping a building and be able to advise as to when and how work should be done. The most versatile of the solicitors should be the man who works among present users, the service supervisor. He should be posted on all known devices applicable to his prospects, each having some value to the central station in increasing its return from present users.

HOW TO MEASURE RESULTS AND PAY SOLICITORS.

Mr. Leon H. Scherck said it is easy enough in any growing community to increase the gross earnings of a property, but is is not so easy to produce results commensurate with the investment. It is logical to pay for bringing in new business in such a manner as to encourage only profitable business and discourage the opposite kind. He believed that solicitors should be paid a fair salary to cover living expenses and in addition a commission to be based on the net return of the business they have brought in; but he would allow a commission only on new business that remained on the company's books for a certain length of time, say, six months. He would also figure only on the revenue from this new business in excess of a certain amount per kilowatt demand. Payment of solicitors purely according to connected load is entirely wrong from its very nature, as it encourages what in reality amounts to false returns. One should not be looking for a big connected load; what is wanted is a paying load, and it seems therefore sensible to pay on an equitable, though somewhat complicated basis rather than on an inequitable but simple plan.

In discussing this subject Mr. H. N. Wrightington believed that paying solicitors commissions purely on net revenue or appliance sales was not right, because some solicitors having a better territory or landing some unusually large contract would have unjustly large commissions. His plan was to set aside for commissions an amount based on the total increase in the net revenue of the company. Each solicitor is then paid out of this sum his percentage of the total increase.

ILLUSTRATED LECTURE ON ADVERTISING.

Mr. C. W. Lee gave a lecture illustrated by stereopticon views of different styles of advertising. By way of introduction he referred to some of the rather absurd questions asked in the "Question Box" as to which is the best, newspaper or street car advertising; or which is the best, advertising or solicitation. These are much like the old question, "Which would you rather do or go fishing?" The fact is, all these things have a place in a new business campaign. He then had thrown on the screen reproductions of direct-by-mail advertising, newspaper advertising, circulars, bulletins and campaigns carried on to influence public sentiment in favor of the company.

THE VALUE AND USE OF A SOLICITOR'S HANDBOOK.

Mr. R. S. Hale, of the Boston Edison Company, described briefly the uses of the handbook which that company issues for the use of its agents. Some agents keep handbooks with them constantly; others keep them on their desk for reference purposes. Men who keep their books up to date and are familiar with them find them very valuable, indeed. A letter was published from Mr. L. D. Gibbs, of the Boston new-business force, telling of the instruction he received from the handbook without any previous technical knowledge.

EDUCATION OF THE SALESMAN.

Mr. J. D. Kenyon, vice-president of the Sheldon School of Scientific Salesmanship, Chicago, made a short address on the importance of training salesmen and the possibility of greatly improving the solicitor's work by proper training.

HOW TO MAKE THE MOST OF NEWSPAPER ADVERTISING.

was taken up by Mr. A. D. Mackie. Advertising writing requires a specialist. Advertising right requires thought, individual treatment and undivided attention. Newspapers should be used as a forerunner to more direct methods of publicity. The advertising campaign should be laid out a whole season in advance, so that at the beginning the advertiser knows what kind of an advertisement he is going to use at the end of the campaign. A legitimate business can easily be ruined by misrepresentation. Be brief. Have something to say. Say it. Stop.

MEASURING THE RESULTS OF ADVERTISING.

Mr. M. S. Seelman, Jr., expressed the opinion that advertising should be responsible for and produce directly and indirectly at least 60 per cent of the new business. He showed in his paper a number of examples of advertising used by the Edison Electric Illuminating Company, of Brooklyn. He pointed out that one of the great advantages of the workings of the direct-by-mail system is that once the original material is prepared the working of the system can be done by comparatively inexpensive help. Solicitors should be made as a part of their work to furnish each day the names of a certain number of prospects to which matter should be mailed. In Brooklyn each solicitor is required to send in three names daily, indicating also the character of the advertising to be used. In Brooklyn it is thus a continuous performance and in three or four days 200 or 300 follow-up names accumulate. Record cards are made out and the first letter of a series is mailed. The volume of results necessarily depends on the vitality of the lists and the effectiveness of the advertising. In Brooklyn, for example, the results for the last month on which figures are obtainable, April, 1907, are as follows: During that month the bureau completed the work of sending follow-up literature to ten lists comprising 1660 names. This includes only those lists actually closed up in April. To these 1660 addresses were sent 9262 pieces of advertising. The cost for printing, envelopes and postage was $195. One hundred and three of the 1660, or 6.2 per cent, signed contracts during April. Of these 29 were the direct result of post-card returns, while 74 were signed as the result of special solicitation coincident with or immediately following and co-operating with the advertising directed and supervised from the office. Thirty-two of these contracts were for signs at a flat rate of $91 a year, yielding an annual revenue of $2,912. One was for a sign that pays $144 a year. The other 70 contracts, mostly for store lighting, aggregated business amounting 2415 50-watt lamps, the annual revenue of each such lamp averaging in Brooklyn about $3. At this figure the revenue from these 70 contracts would amount to $7,245 a year. The total annual revenue from the new business gained in this month in connection with this portion of the company's advertising is thus seen at $10,300. This was in a territory where careful solicitation had been carried on for years, and not in virgin soil.

DISPLAY AND DEMONSTRATION ROOMS AS BUSINESS GETTERS.

Mr. E. R. Davenport in a paper on this subject showed views recently taken of the Boston Edison Company's display-room; also the display-room of the Narragansett Electric Lighting Company, of Providence, R. I. To obtain the best results a display-room should be located on a prominent street with large show-windows brightly and attractively lighted and kept open evenings. Everything electrical installed should be connected and ready for demonstration at all times. The man in charge should be thoroughly familiar with the details of every device exhibited. Young women as demonstrators on domestic appliances are usually the most satisfactory. The announcement of the opening of a display-room and also the appliances being demonstrated at different intervals can be done through the columns of the local newspapers, in addition to printed invitations. It is a good plan to have some attraction in the window after the usual closing time; for example, a large Holophane

hemisphere with self-flashing colored lamps arranged to burn all night. This can be replaced with the winking owl and other novelties from time to time. Different methods of window lighting can be advantageously shown in your windows and the wiring arranged so that one method of a kind can be shown at a time. Interior lighting can be arranged for display also to show the different methods of illumination, together with various styles of fixtures for use in the home, store and office.

NEW BUSINESS BY INDIRECT METHODS.

Mr. L. D. Mathes, of Dubuque, Ia., described and gave the cost of a series of lectures and demonstrations on cooking given by the Household Economics Division of the Dubuque Woman's Club, with the support of the Union Electric Company, of that city. The principal facts in connection with this enterprising movement were given in the report of the Iowa Electrical Association convention. Mr. George Steinwedell, of St. Paul, described indirect methods used in St. Paud, where elaborate demonstrations were given in connection with a pure food show in that city. A second show of the kind in which the company took part was called "The Streets of Paris" given by the Junior Pioneers.

ILLUMINATING ENGINEERING AS AN AID TO SECURING AND RETAINING BUSINESS.

Mr. C. F. Oehlmann, illuminating engineer of the Union Gas & Electric Company, of Cincinnati, Ohio, gave some very practical points in connection with this subject. He stated that Mr. Henry L. Doherty was probably the originator of this line of work when a year or two ago he organized a service supervisory department in the new business department of the Denver Gas & Electric Company, under Mr. Clare N. Stannard. These service supervisors assumed the responsibility of seeing that present consumers were getting the best possible results for the money they were paying. As soon as they had given consumers a higher efficiency on the present installations, it was easy to close additional business. While these service supervisors were not at first illuminating engineers, they probably inaugurated the idea of the illuminating engineer in connection with the new business department. The business-getting illuminating engineer is a very recent character, and the work has progressed only far enough to enable one to form but a fair idea of his value in this field. The work of the illuminating engineer is not only to call upon architects, contractors and owners of new buildings, but to adjust complaints by the rearrangement of what has been a poor lighting scheme and to educate the representatives and salesmen of the new business department. The latter is the real work of the illuminating engineer and is what makes his work valuable to the station. The salesmen and representatives of the new business departments should be familiar with all new reflectors marketed and their use. They should know how to place lamps to the best advantage and should know how to figure cost of operating and maintaining installations. These things should all be taught by the illuminating engineer. The illuminating engineer should spend half a day as often as possible with each representative in his respective territory or district, going to different stores, residences, halls, churches, etc., and advising with the representatives as to the best plan of illumination. These half days, with short lectures each week and daily discussions of new lamps and reflectors, will constitute a splendid method of educating the new business department man and place the illuminating engineering feature on a par with any work being accomplished by the various central stations.

CO-OPERATIVE LIGHTING OF STREETS BY MERCHANTS.

Mr. H. J. Gille described the methods used to secure the lighting with ornamental lamp-posts of the principal business streets of St. Paul, and gave illustrations of the posts used. An article covering this interesting work at St. Paul will be found in The Electrical World of March 2, 1907.

SOME METHODS OF SECURING SIGNS, OUT-LIGHTING AND WINDOW-LIGHTING.

Mr. Homer Honeywell, taking up this subject briefly, described the methods of securing this class of business at Lincoln, Neb., which have already been taken up in The Electrical World in connection with the reports of the last Northwestern Electrical Association and in a previous article.

OTHER VALUABLE PAPERS.

The following are some of the valuable papers presented, some of which will appear in abstract in later issues: "Preparing Lists of Prospective Customers," by George Williams; "Advertising Results Demonstrated," by E. S. Marlow; "The Value of the Service of the Advertising Agency or Specialist," by Lawrence Manning; "Methods of Securing Residential Business," by R. C. Hemphill, Jr.; "Power," by George N. Tidd; "Catering to Energy for Automobile Charging," by R. W. Rollins; "Establishing Day Circuits in Towns of 10,000 Population and Under," by F. H. Plaice; "Commercial Methods of Exploiting Heating Devices," by Theo. K. Jackson.

EXHIBITORS TO ORGANIZE FOR NEXT CONVENTION.

On Thursday morning the representatives of the various manufacturing companies and electric supply houses met in the pink room of the New Willard Hotel for the purpose of forming a permanent organization to look after exhibits at future conventions. This organization will have a permanent secretary and exhibition manager, and will work in harmony with the National Electric Light Association. It will relieve the larger organization of the vast amount of detail work connected with exhibits at conventions, which work has now assumed such proportions as to necessitate some such separate organization for it proper handling. A committee was appointed and instructed to confer with the officers of the National Electric Light Association with reference to the organization. The committee consisted of Messrs F. H. Gale, of the General Electric Company; J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company; W. B. Hager, of the Allis-Chalmers Company; C. P. Frey, of the Weston Electrical Instrument Company; R. Gilder, of the Crocker-Wheeler Company; H. M. Post, of the Western Electric Company, and C. W. Lee, of the C. W. Lee Company.

NEW OFFICERS.

At the executive session held at the close of the convention the following named officers were elected for the ensuing year: President, Dudley Farrand, Newark, N. J.; first vice-president, Alex Dow, Detroit, Mich.; second vice-president, W. C. L. Eglin, Philadelphia; secretary, W. W. Freeman, Brooklyn, N. Y. Executive committee: George H. Harries, Washington; A. J. DeCamp, Philadelphia; Samuel Scovil, Cleveland.

Engineering Plans Exhibited at the N. E. L. A. Convention.

A most interesting exhibit for central station men made at the National Electric Light Association's Convention was prepared by the Committee on Engineering Plans, consisting of Philip Torchio, B. A. Behrend, P. Jungersfeld, W. C. L. Eglin, C. W. Stone, D. L. Huntington, Barret Smith, B. G. Lamme and Sidney Hosmer. The exhibit consisted of portfolios of blue prints, drawings, photographs, etc., of structural details, boiler rooms, turbine rooms, switchboard diagrams, distribution systems, cable terminals, typical sub-stations, transmission lines, coal handling apparatus, machinery, etc. The companies contributing to the exhibit were the Allis-Chalmers Company, the Boston Edison Company, the Chicago Edison Company, the Detroit Edison Company, the General Electric Company, the New York Edison Company, the Ontario Power Company of Niagara Falls, the Washington Water Power Company, the Westinghouse Electric & Manufacturing Company, and J. G. White & Company. At the close of the convention the exhibit was presented as a gift from the association to the George Washington University at Washington, D. C. The gift should be of very great value to engineering students in that it gives detail plans, etc., of the most modern practice in everything pertaining to central station design.

Annual Convention of the International Independent Telephone Association.

The annual convention of the International Independent Telephone Association was held at the Auditorium Hotel in Chicago, June 4, 5 and 6. The convention was opened by W. A. Evans, health commissioner, who, representing Mayor Busse, welcomed the assembly to the city. Mr. H. D. Critchfield, of Milwaukee, responded to the address of welcome. President James B. Hoge in his annual address spoke of the possible development of the telephone industry in the country, saying that in Los Angeles there is a telephone for every four persons. He recommended that the association be incorporated under the laws of some state and that it be controlled by a board of trustees. Regarding flat versus meter rates, he said there is a growing tendency to charge for electricity and water as well as for telephones on a meter basis. The year's record in the building of long distance lines was greater than ever before, but the price of copper had checked construction work. He said statistics showed that over 85 per cent of long-distance messages were sent to a point within a radius of 50 miles of the point at which they originated. He thought it would be well for the association to have a traveling secretary to work out uniform methods for the different sections of the country. This secretary, he thought, should attend all the state conventions and in order to facilitate this and to cut down expenses, he believed it would be well to hold these conventions in neighboring states one or two weeks apart.

The report of Assistant Secretary John A. Harney showed an increase of 10,042 independent telephone companies during the year, and he reported that the shield, the emblem of the association, was in use in forty-four states.

The treasurer's report showed disbursements of $18,241.60 during the year which left a slight deficit. The remainder of the morning session was given up to "short talks on practical subjects." These included "Construction Problems," "Shield Advertising" and "Collection Methods."

The question of "shield advertising" resulted in the reading by Charles West, of Pennsylvania, of a law recently passed in that state which prohibited the use for advertising purposes the U. S. flag and other national emblems. Senator C. W. Cline, of Pennsylvania, said that it had been explained to him that the act was intended to prohibit the desecration of the American flag and he did not believe that it would apply to the shield.

Under the subject of "Collection Methods," Mr. J. D. Rhodes, of Ohio, said the best way of making collections is to give good service and then hammer constantly to get the money.

The Wednesday morning session was opened by C. E. Tarte, of Grand Rapids, Mich., who read a paper entitled "Independent Improvements and Possibilities." Mr. Tarte said that the stockholders in the independent telephone companies are in all walks of life, and being usually local, they know the habits of the people and their company can, therefore, give better satisfaction than companies managed from distant points. He said the weakness of the independent telephones is in the long distance lines and he urged that these lines be constructed. Each station, he said, should have its own traffic association to take care of operating, rules, rates and methods of handling business. In discussing the long distance question, Senator Cline, of Pennsylvania, said that the sooner it is realized that the long distance business must be separated from the local business the better it would be. He thought that all interests in each state should get together and form an overlying long-distance company. The management should be independent of the local companies.

In the absence of President Hoge from the chair, Senator Cline, as chairman of the committee on resolutions, presented a resolution incorporating the thanks of the association for the able manner in which Mr. Hoge had presided over it and providing for the presentation of an engrossed copy of the resolution to President Hoge. A second resolution discountenanced the infringement of one independent company on the territory of an already established company giving satisfactory service, and provided for the recognition by the National Association of the first company on the ground.

In response to the resolution passed concerning the manner in which the affairs of the association had been conducted during his incumbency, President Hoge said that during the three years he had occupied the chair, the association had become dear to him, and his sole object in the work had been to get an aggregation of interests to pull together. Regarding the growth of the association, he said that two years ago there were 300 delegates; last year there were 750, and that this year there are about 1000.

Mr. Lindermood, of Indiana, as chairman of the committee of credentials, said there was a misunderstanding as to whether representation should be based on the number of independent units in each state or on the number of companies belonging to the association. Mr. Lindermood's remarks resulted later in an amendment of the constitution.

The roll call of states showed the general progress of the independent movement throughout the country. Alpheus Hoover, reporting for the Canadian association, said the number of absolutely independent companies, or non-Bell companies, is 73; there are 3248 shareholders and 6427 subscribers. In the California report it was stated that in the territory embracing 100 square miles there is one independent telephone for 8⅛, or one telephone for 4½ people.

At the afternoon session the roll call of the states was continued. W. H. Nelson, of Kansas, reported that the relative strength of the independent and Bell companies in his state is 3 to 1 in favor of the independent. During the past month, the state association had a traveling secretary in the field, and results obtained made them feel that the money was well spent. He said the greatest enemy the independent people have is the rural mutual companies; but he believed the organization of these companies to be a fad which would die in time as the promoters would learn sooner or later that telephone companies must be run on business principles.

In his report for Illinois, Mr. Cheatle spoke of a unique feature that had been adopted in connection with the state convention. This was the school for operators. There were fifty operators enrolled and these were instructed by a competent lady instructor. The proposition was to make the convention as much a practical one as possible.

Mr. Deering, from Iowa, reported that the toll lines in his state were very largely local in character but longer lines are being built. During the past year the state association had a traveling agent in the field with good results.

Mr. E. B. Fisher said that in Michigan the greatest progress was in the city of Detroit, where an independent system with about 15,000 subscribers would be put in service this fall. He said a State Managers' Association had been organized and very valuable papers were presented at the meetings.

Mr. Lindermood, of Indiana, reported that several sub-licensee companies had severed connections with the Bell company. With an addition of only 8 per cent on investments the gross earnings of telephone interests in Indiana had increased 16½ per cent. Out of 385 companies, only one company had gone into liquidation and this was a sub-licensee of the Bell company.

R. E. Mattison, of Nebraska, said they had issued a state directory which had been the means of getting many subscribers.

D. B. Beam, of Ohio, said that every county but one in the state has independent companies. At the annual meeting of several of the companies special efforts were made to have a local representation of stockholders. The meeting of his company took the form of a banquet which practically all the stockholders attended.

According to the report of Mr. Tetu, of Oregon, the independent people are ready to give service in Portland and are about to build in Salem.

Mr. Charles West, of Pennsylvania, reported that his state has 328,000 miles of toll lines. Recent efforts had been confined largely to filling in short gaps. He said a movement is on foot to build a first-class line through from Philadelphia to Pittsburg.

"The Strength of the Chain" was the subject of a paper presented by Mr. James S. Brailey, of Toledo, Ohio. In the paper Mr. Brailey brought out the idea that in addition to giving self-protection, one duty of the independent telephone organizations was to promote the telephone business in general, notwithstanding the fact that competitors would receive help. He urged that the telephone habit be promoted, saying that it is a permanent one, as in hard times people would do without electric light and would abandon street cars, but that they would not give up the telephone.

The committee on standard forms of accounting reported through Chairman Charles West that much data had already been prepared and that the committee expected to continue its work. Upon its recommendation the committee was continued for another year.

Mr. J. P. Boylan, of Detroit, presented the report of the committee on standard operating rules and regulations. As the report was a very long one, he recommended that it be printed in book form.

The report of the committee of physical standards was presented by Chairman Edward E. Clement, of Washington, D. C. The committee endorsed the report submitted at the previous convention and recommended that no steps be taken to restrict companies in their decision as to types of systems or apparatus. It recommended standardizing incandescent lamp bases and machine screws and threads and urged the adoption of a unit of carrying value for telephone circuits. The report stated that much money was wasted in writing lengthy and impossible specifications and suggested that the committee supply from time to time standard specifications for the real requirements. To carry on the work that should be done the committee wanted an engineer to work under its general direction and an appropriation of about $5,000.

Under the subject "Compulsory Interconnection of Bell and Independents," Mr. J. B. Earle, of Waco, Texas, gave an account of the recent legislation in Texas concerning interconnection of telephone and telegraph companies. The bill as finally passed provides that telephone and telegraph companies shall make connections at common points, but that no company shall be compelled to receive any message originating at a point on its own lines. Connections shall be made by order of the city council, or where none exists, by the commissioners' court The discussion brought out the fact that neither the Bell nor the independent interests favor interconnection. Interconnection is detrimental to the people in that it would eliminate all but one company from the field and thereby do away with competition. It would retard development because no company would go into a town when compelled to connect with an already-existing company. Confusion would result by the springing up of small companies demanding connection.

The Thursday morning session was opened by J. M. Plaister, of Ft. Dodge, Ia., who gave an account of the organization and business of the toll line clearing house in his state. Difficulties had first been experienced because of the use of approximate instead of exact mileage and trouble had been occasioned in prorating messages paid for in coupons sold at a discount. He urged the discontinuance of the sale of coupons at a discount, and recommended the use of numbered tickets for recording messages.

In a paper entitled "Where the Copper Comes From," J. S. Haley, of Livingston, Mont., gave a report of conditions in his state. He divided the state into three districts, the western portion occupied by Bell companies, the central and eastern portions each occupied by an independent company. All of the companies are interconnected.

Inquiries submitted to the question box resulted in several interesting discussions. Regarding the use of iron and copper wire, Charles S. Norton, of Indianapolis, said he had found No. 12 iron wire answered for lines up to 25 or 30 miles long. Iron lines cost less than copper and are cheaper to maintain. He is using No. 8 iron wire for distances up to 75 miles with as good results as No. 12 B. & S. copper. Tests showed that during a period of 12 months the time working efficiencies over 8000 miles of wire had been with No. 8 iron, 97.6 per cent; No. 12, 97 per cent; No. 10 copper, 97.2 per cent; No. 12 copper, 96 per cent.

The question as to the best way to impress upon the public the fact that the cost of operation per unit increases with the number of units resulted in the suggestion that records be kept from year to year showing the cost of operation per circuit and that the figures be used to substantiate statements as to increased cost. A query as to whether or not independent telephone companies are using all their opportunities for revenue brought out the suggestion that the wires be used in connection with fire alarm and watchman's service.

W. B. Woodbury, of Detroit, reported that the committee appointed to confer with the manufacturers and publishers regarding raising funds had succeeded in getting $6,700, and had pledges for $1,775 in addition. A motion was passed thanking the various donors for the manner in which they had responded.

In a paper entitled "Making History in the Canadian Northwest," Francis Daggar, provincial telephone expert of Winnipeg, Manitoba, told of the legislation in the district favorable to independent telephony. The laws provide that municipal bonds may be issued for the construction of telephone systems in municipalities in which 60 per cent of the voters' signatures are obtained.

Charles E. Sumner, of Portland, Ore., spoke on the Washington situation. This was in reference to the order issued from Washington a few years ago to the effect that post offices subscribe for but one telephone system and that this system be one having direct connections with Washington. This compels the use of Bell telephones. Mr. Sumner said this order works hardship on telephone users in many places, as in Toledo, where there are 12,000 independent telephones and 4000 Bell instruments. He stated, however, that since coming to the convention he had heard that the order had been rescinded.

Letters were read from the hotel and newspaper men at Atlantic City and from Mayor Becker, of Milwaukee, inviting the association to hold its next convention in these cities. The nominating committee, composed of Dwight E. Sapp, Richard Valentine, E. L. Barker and Charles West, made the following report:

President, Theodore Gary, of Missouri; first vice-president, Frank L. Baum, of Ohio; second vice-president, Charles E. Sumner, of Oregon; third vice-president, E. B. Fisher, of Michigan; fourth vice-president, Alpheus Hoover, of Ontario; secretary, Charles West, of Pennsylvania; treasurer, Manford Savage, of Illinois.

In accepting the president's chair, Mr. Gary assured the association that he appreciated the distinction and that he esteemed the honor more than to be elected to the governorship of any state in the Union.

The committee on constitution and by-laws reported several changes which were afterwards adopted. The clause regarding the time of the annual meeting was changed with the idea that if deemed advisable the meetings might be held at the time of the Chicago Electrical Show.

Provision was made for the formation of different sections in the association for manufacturers, honorary members and others, in accordance with recommendations made by President Hoge in his annual address. The basis of representation was made more definite providing one representative for each 10,000 units represented by membership in the state territory or provincial association. The executive committee will select an auditor who will audit the association's accounts twice each year. On a motion made by Mr. Hoge the words "of America" were stricken from the name of the association.

High-Tension Transmission.

In our June 1 issue we printed a news account of the special meeting of the American Institute of Electrical Engineers held in Chicago, May 24, the programme of which was entirely confined to subjects relating to high-tension transmission of power. An account was also included of the visit at the end of the meeting to the 60,000-volt transmission plant at Grand Rapids, Mich. Below are given abstracts of the papers read at the meetings, and of the discussion thereon.

COMPARISON OF THREE-PHASE AND ONE-PHASE TRANSFORMERS.

In his paper on the relative merits of three-phase and one-phase transformers, Mr. H. W. Tobey stated that with reference to the initial cost the three-phase transformer has a distinct advantage. All things considered, the cost of a three-phase transformer may be taken as about 85 per cent of that of three of the one-phase type, the total capacity, frequency and voltage being the same, of course, in the two cases. In regard to the floor space and height the three-phase transformer has distinct advantages, as a saving of at least 30 per cent can be attained in floor space, and usually its height is somewhat less than that of the one-phase unit. As far as reliability is concerned, the two systems are about equal, and as regards regulation neither system can claim an advantage. In small transformers suitable for pole suspension the advantages of the three-phase transformer are emphasized in appearance and reduction in weight. For extremely large three-phase units it is probable that some system of forced-oil circulation would be adopted, because by this means the large coils and extremely large mass of iron necessary to form the magnetic circuit may be cooled without difficulty. The author concluded that where the plant is of small or medium size, the facilities for handling limited, and the floor space not an important feature, groups of one-phase transformers would, without doubt, be adopted. For large plants, however, having ample facilities for handling, and particularly where floor space is a problem of importance, the three-phase type would be more suitable.

Mr. John S. Peck considered the advantages of three-phase and one-phase transformers, comparing the three-phase transformer with a group of three one-phase transformers whose aggregate output is the same as that of one three-phase transformer. On this assumption the advantages of the three-phase transformer over the one-phase group are as follows: First, lower cost; second, higher efficiency; third, less floor space and less weight; fourth, simplification in outside wiring, and fifth, reduced transportation charges and reduced cost of installation. The disadvantages are: First, greater cost of spare units; second, greater derangement of service in the event of breakdown; third, greater cost of repair; fourth, reduced capacity obtainable in self-cooling units, and fifth, greater difficulties in bringing out taps for a large number of voltages. After discussing each of these advantages and disadvantages in detail, the author concluded that the three-phase transformer has certain real and positive advantages over the one-phase type, while its disadvantages are chiefly those which result in the event of breakdown—an abnormal condition which occurs at rarer and rarer intervals as the art of transformer design and manufacture improves. As on the Continent the three-phase transformer has already superseded the one-phase in most cases, so in America and Great Britain the use of the three-phase transformer will show a very rapid increase within the next few years. He expressed the opinion that a three-phase core type transformer has a better performance than a shell type and can be built for less money. Moreover, the core type can be repaired more readily and is therefore more desirable than the shell type.

In the discussion of the paper, Mr. A. H. Pikler said that the development of the three-phase transformer in this country has been remarkably slow in view of its extensive use abroad. The fact is due in part to the inclination of Americans to use as far as possible standard interchangeable apparatus, but rather more to the patent situation, which hinders development. The manufacturers can make larger profits on three-phase transformers. He expressed his preference for the core-type of transformer with butt joints in the magnetic circuit, and referred to his article in the ELECTRICAL WORLD of Jan. 6, 1906, comparing the relative merits of shell-type and core-type transformers.

A written communication by Mr. P. Junkersfeld called attention to the fact that the one-phase transformer may be better in a small system where reliance is placed on only a few units, but in a large system the three-phase type has unquestionable advantages. The Chicago Edison Company has installed about 42,000 kw in three-phase transformers. On the whole, there has been less trouble with the three-phase transformers than with the one-phase, although this has been due partly to the fact that the three-phase transformers are of later design and special care was given to the taps and terminals.

Mr. C. W. Stone said that the three-phase transformers are specially adapted for use on poles and in manholes in the smaller sizes. There is less chance for poor line work in the installation of one transformer than when three are put on a pole or in a subway. The total percentage of breakdowns of transformers is now so small that it need not be considered.

Mr. W. S. Moody remarked that he has been connected with the design and construction of some 450,000 kw in three-phase transformers during the past five years. He does not favor the core-type of construction. The ease of repair with the core-type is more than offset by the likelihood of extensive damage to the transformer in the case of a burn-out. There is trouble with the insulation around the bolts in the core-type.

Mr. W. B. Jackson emphasized the importance of being able to maintain service after one or two transformers have been disabled by lightning. Many plants have trouble with lightning, and in certain cases the ability to operate with two single-phase transformers on a three-phase circuit when one of the bank of three is disabled by lightning has saved the service from interruption. If three-phase transformers had been in use in such cases the whole plant would have been put out of service.

Mr. Paul M. Lincoln thought it difficult to bring out and properly insulate three leads on very high voltage transformers.

Mr. C. W. Stone said that it is easier to bring out three leads in one three-phase transformer than to bring out and connect six leads from three one-phase transformers.

Mr. P. D. Wagoner stated that the one-phase transformer is better for lighting distribution systems feeding low-tension circuits because with such it is desirable to tap off single-phase lighting circuits at different points on the primaries.

Mr. A. H. Pikler showed that the trouble around the bolts on core-type transformers mentioned by Mr. Moody is not experienced on any properly-made core-type transformer. The magnetic reluctance is greater in the shell type than in the core type, because the reluctance of the butt joint on the core type is less than the reluctance of the lap joint formed by laying one insulated iron plate over the end of another, in the shell type. The shell type must be built up sheet by sheet and the method of supporting the coils in the shell type is necessarily bad for the insulation of the corners where the principal pressure of the coils on the core comes.

Mr. E. N. Lake remarked that although the three-phase transformer is best for use in large sub-stations on large systems, it is not good on smaller systems. He cited the examples of an interurban railway line having 10 transformers in various sub-stations. In this case four transformers can be disabled and the road can continue to operate.

Mr. H. B. Gear said that for overhead work a small three-phase transformer does not offer any saving over three one-phase transformers in cost of installation. The weight of a 60, 75 or 90-kw three-phase transformer is so great that it was awkward to handle, whereas three 20, 25 or 30-kw one-phase transformers can easily be hung in the ordinary way without the construction of any elevated platform; hence the total cost

is no greater for the three one-phase units. In underground work, a 60 or 75-kw three-phase transformer requires a special manhole cover, as it is too large for the standard size. As far as the cost of the two types of transformer is concerned, it may be stated that in the case of one large company at least the prices quoted for three-phase as against one-phase were not sufficient to justify the selection of the former. The most serious objection, however, to the three-phase transformer for general distribution work is that of having another variety of transformer to be kept in stock.

Mr. J. W. Farley thought the discussion should not be so much as to which type of transformer is best, because all admitted that there were certain places where the three-phase transformer is better adapted and vice versa. The question which should really be discussed is as to where the dividing line should be drawn between the use of one-phase and three-phase transformers.

OVERHEAD GROUNDED CONDUCTORS.

Mr. R. P. Jackson presented a paper giving a theoretical investigation of the potential gradients and the equipotential surfaces about grounded conductors suspended in the air and also about metallic towers for supporting transmission lines. He assumed that the potential gradient between a charged cloud and the ground is approximately a straight line near the ground and determined in what way the gradient will be altered by the presence of a grounded conductor some distance above the earth. As a practical example the author assumed a wire ½-in. in diameter placed 50 feet above the ground and the potential gradient was taken as 2 per foot. Thus, if the wire were not present the potential at the point where it has been assumed to be would be 100. By determining the distribution of the potential in the neighborhood of the wire, it was found that when there was a charged cloud overhead at a point 5 feet below the grounded wire the potential would be about 55 per cent of that which would exist if there were no grounded wire. After the cloud has discharged there would be only 55 per cent as great a potential on the wire and consequently only 55 per cent as great a charge to escape suddenly to the ground. The above deductions are based on the assumption that the transmission wires are completely insulated, both from the ground and from the other parts of the circuit not affected by the cloud potential. If the line were so insulated that a partial charge could leak to the transmission wires, the primary stresses would be reduced somewhat but the grounded wire would still have a beneficial effect. The author concluded, first, that properly placed and grounded conductors above a transmission line ought materially to reduce electrostatic stresses to which the insulators will be subjected; and second, that an insulator interposed between a high metallic structure and the sky without a grounded conductor above the insulator to act as a shield is exceptionally liable to breakdown.

Mr. P. M. Lincoln, chairman, showed that Mr. Jackson's paper took up the question from a purely theoretical standpoint. Engineers hold very opposite opinions as to the value of overhead ground wires. Some think them extremely good and others the essence of all that is bad.

Prof. D. C. Jackson stated that the increasing use of steel tower construction for transmission lines is changing the entire aspect of the problem of overhead ground wires. A ground wire on a wooden pole has the practical effect of bringing the ground potential to the pole top so that the insulating effect of the wooden pole is partially lost. In the case of steel towers, however, the ground potential is brought up to the insulator pin in any event. No insulation is therefore lost by introducing an overhead grounded conductor. Prof. Jackson's paper shows that approximately a 50 per cent reduction can be made in the strain to which the insulators will be subjected. Practically he had thought (or at least had made himself think) that a reduction of about 25 per cent in electrostatic strain might be obtained on steel towers by the use of overhead lightning conductors.

Mr. Smith pointed out that concrete poles such as are used on the Illinois Traction System are practically equal to wooden poles in insulating qualities.

Prof. Morgan Brooks announced some tests which had been made at the University of Illinois on the effect of connecting transformers in circuit at different points on the alternating current wave, and introduced Mr. J. W. Andree, who conducted the tests. He outlined the results. It was found that the potential on closing the switch with the wave at zero was 12 per cent above normal on the secondary circuit and 33 per cent above normal when the cutting in was done at the crest of the wave.

Mr. H. C. Hoagland, speaking for the Illinois Traction System, said that his company is putting up overhead ground wires for lightning protection as fast as possible.

Mr. George A. Damon asked why an overhead ground connection using the short lightning rod on each pole would not solve the difficulty much better than a continuous overhead grounded conductor. Mr. P. M. Lincoln replied that the combination would not be protection against the lightning which got on the line between poles or insulators.

Mr. George E. Hayler, superintendent of the Spring River Power Company of Joplin, Mo., presented a communication in which that company's experience was related. The line was at first built with a ground wire the entire length of the line, placed about 3 ft. below the cross arms of the transmission line. They had a great deal of lightning trouble principally from the breaking down of the top insulators, the result being the burning off of the top of the pole. Last year between five and six miles of line was built with a ground wire at the top of the pole. There had been no trouble on this part of the line during the last lightning season. A stranded iron wire of large size is used for a ground wire.

Mr. James Lyman gave some information obtained while at Butte, Mont., from Mr. Max Hebgen, manager of several transmission lines running into Butte. One from the Big Hole River, passes over a divide in the mountains where the lightning is so severe that many trees along each side of the pole line have been struck and splintered. On this line three grounded barbed wires were placed on the pole line, two on the upper cross arm and one on top of the pole, and barbed wires were also strung on the trees alongside of the line. These barbed wires were grounded through switches which could be opened for experimental purposes. When the wires were first installed the line operated continuously through thunderstorms without any discharges at the station arresters. As an experiment these switches were opened during one storm and the discharges over the arresters were so severe that great apprehension was felt for the safety of the apparatus. In rebuilding the Madison River transmission line a grounded wire is being used.

Prof. P. B. Woodworth told some harrowing experiences with the stringing of barbed wire on transmission lines in which the barbed wire got away from the lineman and assumed a spiral for some distance around one of the line wires in an evident attempt to get back on the reel. Prof. Woodworth said that he can now appreciate why barbed wire was used in warfare.

FORCED OIL CIRCULATION FOR COOLING OF TRANSFORMERS.

A paper by Mr. C. C. Chesney dealt with a comparison of the forced-oil and forced-water circulation methods for cooling oil insulated transformers. The most recent method of cooling transformers is by forced-oil circulation, which does away entirely with any internal cooling coils, but makes necessary external auxiliary cooling apparatus. The lower part of the windings of the transformer is enclosed in a metal box containing suitable directing plates, and this box is connected to the oil outlet by a vertical pipe raised to the top of the tank and passing through the cover. The outlet pipe has its opening somewhat above the type of the windings, thereby insuring a safe oil level. Oil under a slight pressure is introduced through the inlet pipe and in passing through the transformer the oil is brought into intimate contact with the various windings and

laminations by means of ducts and directing plates. After leaving the transformer the oil flows through an external cooling system containing a surface condenser and strainer and an oil pump, the latter providing the pressure needed to keep the oil moving at a proper rate throughout the entire system. An additional pump is provided to circulate water through the condenser. Sufficient water is usually circulated through the condenser to give 10 deg. C. rise to the water temperature, and the rate of oil flow is usually adjusted to approximately twice that of the water. To offset the additional cost which the auxiliary cooling apparatus represents, there is a less first cost of the transformer proper, due to the markedly more efficient cooling and the prevention of any local heating. If a comparison of the total cost of the transformers installed is taken, there is a balance in favor of the forced oil system in large installations of from 4000 to 5000 kilowatts when composed of individual transformer units of not less than 1200 kilowatts. The author stated that while forced-oil circulation is undoubtedly out of the question for smaller plants and smaller units, it merits for the larger power plants the most careful consideration of any engineer.

ENCLOSED STATION WIRING.

A paper by Mr. F. O. Blackwell described the methods which should be used in order to prevent the occurrence of short circuits and to localize the damage should an arc start from any cause. It was suggested that the following element of principle should be observed: First, the system of connection should be as simple as will give the necessary control over the station; second, the conductors should follow the shortest and most direct route from the generator to the transmission line; third, each conductor should be surrounded and separated from every other by a continuous fireproof barrier; fourth, the circuits should be as far apart as possible.

Mr. C. W. Stone said that many complications in station wiring have been due to the desire for flexibility and to provisions for contingencies which may never arise. Thus there have been used many tie switches which are likely to make trouble. He advises the use of few such ties, but if ties are used enclosed switches should be employed. He also recommended putting the potential transformers on the low-tension side of step-up transformers.

Mr. P. M. Lincoln did not agree with Mr. Blackwell's conclusion that each conductor should be surrounded and separated from every other by a continuous fireproof barrier. For very high tension work he would omit the fireproof barrier. No material is known which is of much value for use as a barrier on circuits of 60,000 volts and over.

Mr. L. C. Marburg said that if the transmission line pass many miles over country without any fireproof barriers, they need not be introduced at the sub-station. Mr. Jameson stated that the absence of barriers would cause many accidents in the power station in the course of a year by the accidental contact of employees with high-tension wires. Barriers are helpful in preventing trouble, even if they do not absolutely prevent it.

Mr. Fay Woodmansee remarked that he did not favor the use of barriers in sub-stations at an extreme end of a line. In the power house where there are many men he would use barriers as much for the protection of life as for the continuity of the service.

Mr. P. M. Lincoln expressed the opinion that the time will come when bus-bars, switches, etc., will be placed out-doors, and only the instruments will be kept in out of the weather. There is no good reason for placing the switches and bus-bars under cover. To carry the barrier idea out to its logical conclusion there should be barriers all the way from the power house to the sub-station.

Mr. W. B. Jackson said that in the far West, sub-stations are built in the open air as Mr. Lincoln suggested.

Mr. E. N. Lake again emphasized the importance of barriers for the protection of life in power houses and sub-stations, as that is the first consideration. His jocose reply to Mr. Lincoln's argument was that if the line wires were as much exposed to employees as are those in the stations, he would enclose them in fireproof barriers all the way from the power house to the sub-stations.

New Telephone Patents.

PROTECTIVE DEVICES.

Ever since the thermal or heat coil has been recognized as an essential part of telephone protective devices there has been felt a need for a self-repairing and self-setting coil. For some years such coils have been available due to the efforts of inventors, most of these working upon a ratchet principle. Such a coil is shown in Fig. 1. The protector springs are held in

FIG. 1.—ERICKSON SWITCH.

position by engagement with the ratchet of the coil. The ratchet wheel is soldered to its spindle and this latter is secured against turning. The heating coil is wound upon the spindle and one terminal of it is connected to the metal ratchet. The circuit is carried through the spring to the ratchet and thence through the coil. If the coil gets too hot, the solder melts, the ratchet turns, releases the spring, cuts the circuit and the cooling solder fixes the ratchet. Everything is now ready for action as soon as the spring is again set against a tooth. The coil shown has been patented by John Erickson, of Chicago, and assigned to the Automatic Electric Company. Such coils cannot conveniently be substituted for ordinary coils in existing plants. It is therefore interesting to find another type of self-soldering coil designed with this in view. The remaining

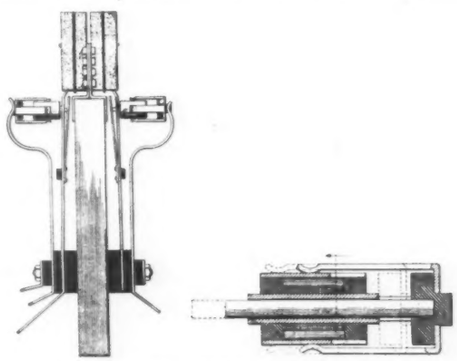


FIG. 2.—ADAMS HEAT COIL.

parts of Fig. 2 show such a coil, the invention of A. H. Adams, of New York City. The action is easily understood. When the solder melts, the pin slides through the spool, the clamping contact fingers sliding down its metal shell. To reset, the coil and spindle now cooled and resoldered, are pulled out and reinserted, inverted. Mr. Adams' patent has been assigned to the Western Electric Company.

LOCK FOR TELEPHONES.

For the case when one wishes to leave his telephone and assure himself it will not be used, F. S. Smith and D. C. Reinohl, of Washington, D. C., have patented a lock. This consists of a flat band adapted to surround the neck of a desk stand above the hook lever. Its width is such as to hold the lever depressed. The band is constructed with outwardly turned ears made to receive the tongue of a padlock.

RINGING DEVICES.

An automatic ringing cut-off for automatic systems has been invented by J. G. Roberts, of Chicago, his patent being assigned to the Western Electric Company. The device is so arranged that after a predetermined period, the ringing will be stopped and a "don't answer" signal toward the caller will be automatically substituted.

Two patents for a step by step ringing system and apparatus

for a party line system have been granted to N. E. Norstrom, of Chicago. The scheme involves a sectional line to be built up from station to station by the operator at central, and under her control the desired station or stations connected to the line and signalled. All this is accomplished without assistance from the individual stations involved.

HIGH-INSULATION TRANSFORMER.

As the use of telephone dispatching in connection with electric railways is progressively extended, the necessity of protecting the telephone user from shocks becomes more and more an important feature. In order to avoid any shock from direct leakage from high-tension lines to the telephone wires upon the same poles, a repeating coil may be used at each station to stop such currents. J. J. Frank, of Schenectady, has under the title "Telephone Transformer," patented the coil shown in section in Fig. 3. It will be seen at a glance how the secondary side is thoroughly insulated from the primary, and how the entire apparatus is shielded from the weather. Mr. Frank's patent is assigned to the General Electric Company.

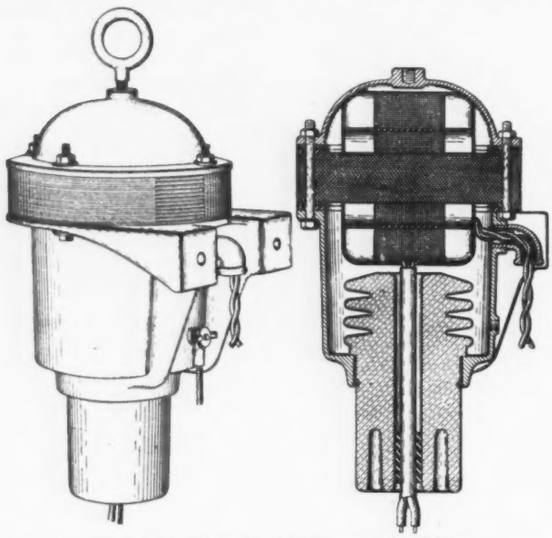


FIG. 3.—FRANK TELEPHONE TRANSFORMER.

SWITCHBOARD.

E. J. Burke, of Brooklyn, has patented a multiple common-battery system with two wire jacks and single strand coils. The plugs have but a single solid shank and change the jack contacts upon insertion. The line lamp receives an intermittent current for calling purposes, while for supervising purposes the same lamp receives a steady current.

Mr. W. W. Dean has obtained a patent for a two-wire, common-battery switchboard circuit, in which the line and cut-off relays are in series in the non-actuated condition. The line relay resistance is such that the cut-off relay will not operate until the insertion of a plug. The supervisory relay is then brought in parallel with the line relay, the combined resistance being sufficiently low to permit the operation of the cut-off relay. This latter relay removes the line relay from circuit.

Another patent granted to the same inventor and with the above assigned to the Kellogg Switchboard and Supply Company, describes a special trunk circuit. This circuit is designed for use between two switchboards of special and different types, upon the call circuit basis. It provides the usual complement of signals.

SWITCHBOARD SYSTEMS.

A call distributing system of operating is planned by J. A. Aven, of Sweden, in which the connecting operators sit before a full multiple, all line signals, however, being concentrated upon an annunciator board. The distributing operator notifies the connecting operator of incoming signals and calls are answered in the multiple by the connecting operator and completed by her.

John Wicks and D. McKay, of Riverside, Cal., have adapted the strowger system to two-party selective working by assigning to each station a line number and then connecting up these terminals oppositely to the same line. From one terminal the ring is on one limb of the line, and from the other terminal the rings, because of the reversed interconnection, are on the second side of the line. W. W. Dean has been granted two patents for special trunk circuits and J. W. Lattig and C. L. Goodrum a patent for a busy test system. These are adaptations to meet the requirements of special switchboard systems.

Letter to the Editors.

Warth Telephone Repeater.

To the Editors of Electrical World.

Sirs—In your review of "New Telephone Patents" in your issues of March 30 and May 11 you comment upon two patents (Nos. 845,282 and 850,079) recently issued to me for telephone repeater systems. A somewhat erroneous statement is made to the effect that "the success of the apparatus seems to depend upon the condenser shunted about one winding of the receiver," etc. I desire to advise you that while I have used condensers satisfactorily as a shunt in the manner shown, your criticism is justified if they are used under certain conditions. The success of the apparatus, however, is not dependent upon the use of a condenser as a shunt. A non-inductive resistance used as a shunt with proper adjustments of the other elements is satisfactory and the shunt may be variously applied to that side of the circuit, as you will appreciate. Several arrangements of means for operating the repeater within the scope of the claims of my patents are possible and known to me and may now occur to others. You realize, of course, that but one way is necessary to illustrate an invention in a patent while the claims may cover that way broadly regardless of modifications as to minor features. As a notable precedent I will cite Professor Bell's original patent covering the speaking telephone. This patent covered broadly such a modification of his apparatus as the subsequently incorporated permanent magnet, while his patent drawing only illustrated an electro-magnet.

Columbus, Ohio. Nathaniel G. Warth.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Determination of Leakage Factor.—R. Pohl.—It is often desirable to have simple methods for the experimental determination of the leakage factor of both main and auxiliary poles. The determination by means of the ballistic galvanometer is nothing more than a laboratory experiment. A method devised by R. Goldschmidt is very simple, but has certain disadvantages. The author describes two zero methods for the direct measurement of the leakage coefficient, σ. They require the use of resistances of known value, "as contained, for instance, in a post-office box, and of a sensitive galvanometer always at hand in connection with the Wheatstone bridge." They require only a very small number of turns, in many cases even a single turn being sufficient, and they also lead to very accurate results. In the first method one turn of wire is wound round one field pole near to the yoke, and another turn round the armature. The two turns are connected in series across the outer terminals of the Wheatstone bridge (Fig. 1) and the galvanometer is joined to the middle terminal and to the point where the two turns are joined together.

The coils are so connected that their induced e. m. f.'s e_{pole} and e_{arm} act in the same direction, and are consumed in the resistances unplugged in the Wheatstone bridge. If these resistances are unplugged in such a way that, when opening or closing the excitation, no deflection is obtained in the galvanometer, the e_{pole} will just equal the drop in the resistance R_{pole} and e_{arm} equal the drop in R_{arm} and we thus obtain at

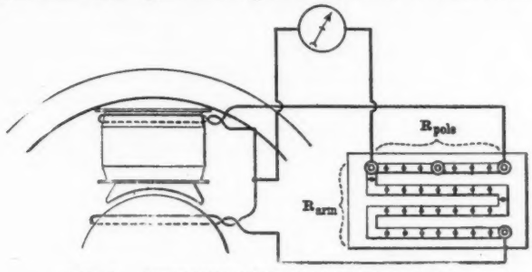


FIG. 1.—DETERMINATION OF LEAKAGE FACTOR.

once the leakage coefficient as the ratio of e_{pole} to e_{arm} or the ration of R_{pole} to R_{arm}. As an example, we may insert 1000 ohms in R_{arm} and increase R_{pole}, beginning with 1000 ohms, until no deflection is obtained when opening the exciting circuits. If, for instance, this is the case for R_{pole} equal to 1150, the leakage factor will be equal to 1.15. Another form of test, which is superior to the above on account of its higher sensitiveness, is as follows: The number of field and armature turns are again made alike. The ends of the field turns are now connected across the outer terminals of the Wheatstone bridge, while the armature turns are connected in series with a galvanometer or millivoltmeter to one outer terminal and one middle terminal of the bridge, the arrangement being so that e_{arm} becomes balanced by a portion of e_{pole}

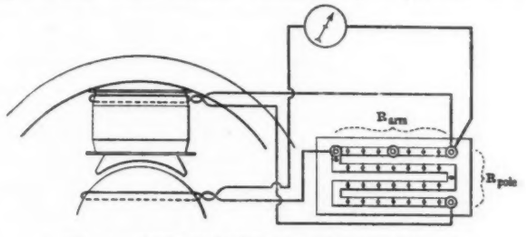


FIG. 2.—DETERMINATION OF LEAKAGE FACTOR.

equal to it, in potentiometer fashion (Fig. 2). Assuming the same leakage coefficient 1.15 as before, we shall now have, for instance, $R_{arm} = 1000$ ohms, $R_{pole} - R_{arm} = 150$ ohms; whereby again the galvanometer will show no deflection when the circuit is opened or closed. This method allows of very accurate determination of the leakage factor, and the time required for it is not more than a few minutes. In testing it was found that, even for small machines, a satisfactory result could be obtained with only one turn each round field pole and armature. The galvanometer was of the moving coil type of high sensitiveness. If an ordinary millivoltmeter is used it will be necessary to have more than one turn; but, in most cases, three or four turns should suffice.—Lond. *Elec.*, May 24.

Single-Phase Motors.—H. R. SPEYER.—An illustrated article on several new types of single-phase motors, like those of Schüler, Fynn-Alioth and Osnos. The author traces the evolution of these motors from the elementary induction, series, and series-repulsion varieties and discusses their relative characteristics.—Lond. *Elec. Eng'ing*, May 23.

Losses in Motors.—C. F. SMITH.—The conclusion of his paper giving brief descriptions of various methods for the experimental determination of losses in motors.—Lond. *Elec. Eng.*, May 17.

Polyphase Induction Motors.—R. D. ARCHIBALD.—A paper on the principle of construction of two-phase and three-phase induction motors.—Lond. *Elec. Eng.*, May 24.

Lamps and Lighting.

Modified Nernst Lamp.—W. NERNST AND L. STOCKEM.—The specification of a British patent for a Nernst lamp which does not need to be preheated. For this purpose the filament is a mixture of conductors of the first and second class (that is, metallic and electrolytic conductors). In such filaments are combined the heating medium and the illuminating agent of the ordinary Nernst lamp. Previous attempts in this respect have shown a short life of such lamps. The inventors have now obtained good results with tungstate of thorium or zirconium or the like second-class conductor; such as tungstate being obtained by chemical action between chemical compounds of tungsten, such as oxide, chloride or nitride of tungsten, or tungsten alloys or combinations with a second class conductor such as thorium oxide, oxide of zirconium and yttria, or the like rare earth. The filament is to be used in a vacuum or in an inert atmosphere, and is to be operated with alternating current in series with a ballast resistance. The mixture of the compound of tungsten with the thorium or zirconium oxide is heated in a reducing atmosphere of hydrogen. For instance, oxide of thorium or zirconium is melted together with tungstic acid in an iridium crucible, in an axyhydrogen blow-pipe, in such proportions as to produce thorium or zirconium tungstate according to the following formula:

$$Th O_2 + 2 W O_3 = Th W_2 O_8$$
$$Zr O_2 + 2 W O_3 = Zr W_2 O_8$$

The tungstate produced is very finely pulverized and heated in a reducing atmosphere. Thereby the tungsten combination is reduced to metallic tungsten, and thorium or zirconium oxide remains unchanged. In this manner a very fine powder is obtained, in which the tungsten and the conductors of the second class are present in the most intimate distribution possible. The filament obtained from such a mixture is stated to be "of a singularly even structure and the process facilitates the production of material of a very even, unchanging quality."—Lond. *Elec. Engineering*, May 23.

Tungsten Lamps.—C. CLERICI.—A paper read before the Milan section of the Italian Electrical Association. The lamps of Italian manufacture exhibited by the author were for 60 candle-power at 100 volts. They absorb 60 watts and consist of six filaments in series, with a total length of 640 mm and a diameter of 0.05 mm. Efforts have been made to produce finer filaments, and some have been made with a diameter of 0.03 mm which would correspond to 20 candle-power for a 110-volt lamp, but it is impossible at present to say whether such lamps can be manufactured on a commercial scale. Life tests of the 60-cp lamps show that the consumption of 1 watt per candle is well maintained for a period of 500 to 700 hours, which compares well with the life of the ordinary carbon lamp of 3.1 watts per candle. A few lamps have run at this consumption for 1500 and even 2500 hours. The 60-cp, 110-volt lamps have a resistance of 33 ohms cold and 170 ohms at working temperature. The tungsten lamp giving 70 candle-power at 70 watts was compared with the carbon lamp overrun to give the same candle-power and efficiency. The filaments were then compared with the following results:

	Tungsten.	Carbon.
Length	6.40	1.75
Diameter	0.085	0.09
Radiating surface in sq. mm	110.	49.5
Watts per sq. mm	0.63	1.41
Candle-power per sq. mm	0.63	1.41

Reducing the carbon to the same candle-power per square millimeter as the tungsten the watts per square millimeter become 1.03 for carbon. Reducing the carbon further to an emission of 0.63 watts per square millimeter the candle-power per square millimeter becomes 0.13. It is thus impossible to obtain similar radiation from carbon and tungsten, the proportion of visible radiation at a given temperature being greater in the metal. But the tungsten lamp has the further advantage of the higher working temperature. The actual working temperatures are 1950 degrees C. for carbon filaments, operated at 3.1 watts per candle-power, 2000 degrees C. for tantalum, and 2300 degrees C. for tungsten. These temperatures are not related to one another as the melting points of the various materials, since carbon melts at 3500 degrees C. and tungsten at about 3200 degrees C. It is probable that they

are rather related in the proportion of the vapor tensions of the respective materials. The working temperature, in fact, depends on the slow evaporation of the material of the filament below the melting point.—Lond. *Elec.*, May 24.

Mercury-Vapor Lamps in Damp Places.—A note stating that mercury-vapor lamps lend themselves very advantageously to the lighting of places where the atmosphere is damp and charged with vapor, and in which the operation of arc lamps is not sufficiently reliable. The case is cited of a factory having a floor area of about 7100 sq. ft. and 14 ft. high, in which 12 Cooper Hewitt lamps are employed for lighting. They are fed two in series off a continuous-current supply at 220 volts. The tube of each lamp is 3 ft. 9 in. long and 1 in. in diameter. By means of an appropriate reflector the light produced is distributed with an illumination of 955 candle-power at an angle of 45 degrees below the horizontal, of 1100 candle-power at 60 degrees and of 1200 at 90 degrees. The consumption is about 385 watts per lamp, giving a total consumption of 4620 watts, or 0.65 watt per square foot of surface lighted. Formerly 24 arc lamps, each consuming 660 watts, or a total of 15,480 watts, were used; the power consumed was then equal to 2.2 watts per square foot of surface lighted.—Lond. *Elec.*, May 24.

Temperature of the Mercury Arc.—C. T. Knipp.—An abstract of an American Physical Society paper on measurements of the temperature of the mercury arc in a Cooper Hewitt lamp by inserting thermo-couples properly protected along the mercury column. With a current which gave approximately the same illumination as in commercial lamps the temperature was found to be 147 degrees C. at the anode, 164 degrees C. at the cathode and 178 degrees C. at the point midway between the anode and cathode. In general the cathode was found to be hotter than the anode, while the midway point was hotter than either. Again, the individual readings obtained at the cathode fluctuated much more than those obtained at the anode, while there was scarcely any variation from a smooth curve either for increasing or decreasing currents at the midway points.—*Physical Review*, May.

Train Lighting.—An illustrated description of the Verity Dalziel system of train lighting in which the lamps are supplied at a constant voltage, the regulation being effected by purely electrical apparatus. The machine employed for this purpose is practically a reversible booster, which maintains the lamp voltage constant by giving a positive or negative boost to the dynamo voltage. An arrangement is provided for switching over to a battery, when the train comes to rest or slows down.—Lond. *Elec.*, May 24.

Photometer.—An illustrated description of the Trotter universal photometer which is based on an application of Crova's law as a means of eliminating the color difficulty, Crova having found that if two lights, differing even as much in color as daylight and an ordinary candle, are both viewed through a yellow screen, thus making them practically monochromatic the relative illumination is thereby unchanged. The arrangement is shown in Fig. 3. A small standard lamp L connected to a 4-volt battery, throws a beam of light which is reflected by the mirror M onto the screen S_1. This is viewed through three small slits in the screen S_2, which receives the illumination to be measured. S_1 can be rotated about its axis, and the illumination thereby varied until a balance of brightness between S_1 and S_2 is obtained. The illumination of S_2 is then read off on a direct-reading scale, 10 in. long, and graduated so as to read from 0 to 2 candle-feet. The scale is almost evenly divided throughout its length, being much more open at the lower end, so that feeble illuminations can be accurately measured. If, instead of the illumination, the candle-power of the source of light is required, the screen S_2 is turned towards it, the correct direction being determined by means of a lens and scale, and the illumination measurement is then made. This value, multiplied by the square of the distance in feet of the photometer from the lamp, gives the candle-power required.—Lond. *Elec. Rev.*, May 24.

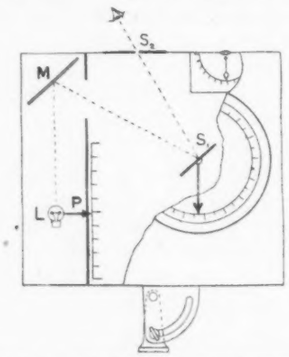


FIG. 3.—DIAGRAM OF PHOTOMETER.

Lamp Testing in Switzerland. Some notes of the co-operation between the central stations, the Association for Buying Incandescent Lamps and the Testing Material Bureau in Switzerland. The latter bureau is consulted whenever there is a disagreement between buyer and seller of lamps. The Association for Buying Incandescent Lamps endeavors to improve the quality of the lamps by means of a systematic control. It is proposed that all central stations establish simple photometric testing-rooms and test 80 per cent of all lamps at their rated voltage as to efficiency, while 20 per cent of every shipment received is submitted to the Testing Material Bureau for tests. The latter Bureau sends only a summary of the results to the central station and retains the test sheets of all single lamps. On the other hand, the central stations are expected to place a summary of the results of their tests at the disposal of the Testing Bureau for use in their yearly statistics. The Testing Bureau supplies standard lamps to the stations.—*Schweiz. Elek. Zeit.*, 1907, page 42; *Jour. f. Gasbel.*, May 18.

Power.

Electric Power in Rolling Mills.—D. S. Bigge.—An illustrated Iron and Steel Institute paper on the development of electricity in the iron and steel industries with special reference to its latest application to reversing rolling mills of high power. For the purpose of complete electrification rolling mills may be divided into two classes, namely, those which have blast furnaces adjacent and those which have not. In case there are blast furnaces available, electric power may be cheaply generated by means of gas engines operated by the blast furnace gases. In such cases "the cost of power production will be found to be very low and should in no case exceed 0.5 cent per kw-hour," while under favorable conditions the cost has been brought down considerably below this figure. Under such conditions the electrification of the whole plant has the following advantages. Now that the electric reversing-mill problem has been solved, it is possible to entirely dispense with all coal-fired boilers and their attendant charges for firemen, etc. Further advantages are, increased output, extreme simplicity, decreased cost of up-keep, absolute control over rolling-mill costs and power absorbed at any stage of all rolling operations by the use of electric recording and automatic instruments. There is further a gain in space and a great reduction in power used in connection with reversing rolling mills, owing to the method of utilizing a balancing converter upon the Ilgner principle; the energy absorbed by the converter, which is derived direct from the central generating station or mains, being about one-tenth of the maximum value or torque upon the mill, even when the load fluctuates on the mill between 0 and 10,000 horsepower. In the event of new mills being laid down the rolling-mill motors can be easily applied direct to the rolls without the necessity of large and costly foundations, as is the case at present with heavy reciprocating steam rolling-mill engines. Owing to the above considerations it is possible in the majority of cases to very largely reduce the power cost per ton of steel rolled. Less than 20 kw-hours are used per ton of blooms rolled, which, in the case of mills having blast furnaces adjacent or waste gases available and producing electrical energy at 0.5 cent per kw-hour, works out at under 10 cents per ton.

The author describes in detail with many illustrations the Hildegardehütte in Austrian Silesia, which has been running for almost a year. It is the first large electric reversing rolling-mill in the world.—A report of the discussion in Lond. *Eng'ing*, May 17; Lond. *Eng'ing*, May 10.

Water Power Versus Steam.—H. VON SCHON.—The third of his articles on hydroelectric power versus steam for industrial plants. The author describes three typical modern water-power stations, namely the plant at Sault Ste. Marie, the plant of the Georgian Bay Power Company, Ltd., of Toronto, Can., and the plant of the Patapsco Electric Manufacturing Company, near Baltimore, Md. Finally, concise data are given on 50 undeveloped water powers in different states in this country.—*Eng'ing Mag.*, June.

Gas Engines.—R. E. MATHOT.—The first of two articles on the design of modern gas producers and gas engines. Some principles of the design of gas engines are given in the present installment.—*Eng'ing Mag.*, June.

Traction.

Three-Phase Traction.—G. B. WERNER.—A paper read before the Electrical Engineering Section of Columbia University. The reason of the adoption of electric traction for steam railroads is to reduce operating costs or to increase earning capacity. The author briefly discusses the electrification of an 80-mile double-track section with an annual traffic of about 1,500,000,000 ton-miles. This calls for the expenditure of approximately $2,500,000, deducting the value of the steam locomotives replaced. The fixed charges on this capital must be charged to the operating expenses and still a material saving must be effected. There will be used about one-half the number of locomotives with electricity as motive power and the total saving in locomotive operation will be from 16 to 22 per cent with electricity, averaging about 18 per cent. The earning power of the road will be raised as a result of the greater horse-power capacity of the electric locomotive per ton of weight. This makes possible a higher traffic density per mile of track by three factors: use of higher accelerations, greater running speeds and heavier trains. The removal of track congestion, due to the fact that higher speeds are possible with heavier trains, raises the revenue-bearing train-mileage and the net income, independent of the greater number of passengers who utilize the better facilities afforded by better schedules, more frequent service and the greater degree of safety and comfort. Further incidental advantages of electric traction are the smaller wear and tear on the track, etc., elimination of smoke, and the greater velocity of train movement and greater readiness for service. The author then discusses some of the structural features of three-phase locomotives, such as have been in actual service for several years in Europe. The current collectors consist of two long rollers mounted on a wooden shaft and rotating in ball bearings, the current being taken from them by carbon brushes. This construction combines the advantages of the trolley wheel in rolling friction with the broad contact of the Siemens bow. The motors are mounted between the driving axles and drive the axles by crank pins and coupling-rods. The author then discusses certain advantages of the induction motor over the series direct-current or series single-phase motor, with respect to efficiency, weight, starting operation, overload capacity and rugged mechanical construction. He then briefly discusses the cascade system of speed control, points out the advantages of the constant-speed characteristic of induction motors for long-distance railway work and the value of recuperation. "The final value of recuperation lies in the fact that the watt-hour per ton mile consumption is reduced from 10 per cent to 40 per cent varying with the degree of the various influences present. The lower watt-hour consumption thus reduces the size of the generating station necessary for the given traffic, and the transmission and transforming apparatus. This result not only decreases the cost of producing energy, but also diminishes the fixed charges on the investment for the electric equipment." A few remarks are finally made on the necessity of two overhead working conductors. The additional investment required for their suspension and insulation is said to be compensated in the saving in weight of copper. The heaviest charge for repairs and maintenance which is the labor for periodical inspection will be the same for two conductors as for one.—*School of Mines Quarterly*, April.

Development of Direct-Current Traction.—A table giving statistical data on the evolution of direct-current traction since 1879. The most interesting feature of the table is the increase of voltage on the trolley wire from 150 in 1879 to 2 x 1500 on the experimental line of the Vienna railroad. The voltage at the motor terminals on the latter line is 750. It is pointed out that this evolution does not seem to have yet reached finality.—*Elek. und Masch.*, May 19.

Installations, Systems and Appliances.

Electricity and Gas.—G. DETTMAR.—An article giving statistical data on gas and electricity in Germany. For the distribution of energy, electricity is now used at least as much as gas. At present electrical generators, with an aggregate capacity of about 750,000 horse-power, are being installed annually in Germany. The capacity of the electric generating stations is at present about 6,000,000 horse-power, the capacity of insulated electric plants being about six times that of central stations for the supply of cities and towns.—*Elek. Zeit.*, May 23.

Starting Induction Motors.—D. A. TRICKETT.—While for small motors the squirrel-cage construction of a rotor has distinct advantages, it is best to adopt a slip-ring rotor for larger sizes. The author briefly summarizes the formulas which indicate the lines on which to design the starting resistances for such motor, stating the procedure to be adopted if complete particulars of the machine are not on hand.—Lond. *Elec. Rev.*, May 24.

Electrophysics and Magnetism.

Theory of Ferromagnetism.—R. GANS.—A paper read before the Berlin Electrical Society. Besides the magnetizing curve $B = f(H)$ it is of interest to also determine the curve $\mu = \rho(H)$ for ferromagnetic substances. In this case the permeability μ is defined by the equation

$$dB = \mu\, d(H) + 4\pi\, dM$$

For reversible changes the right hand of this equation becomes $\mu\, d(H)$, since M is constant. This resolution of dB into two parts has the additional meaning that $\frac{\mu H}{4\mu} d H$ is the increase of magnetic energy and $H\, d\, M$ is heat. M is considered as the true ("wahre") magnetization.—*Elek. Zeit.*, May 23.

Hysteresis and Permeability of Iron in Relation to Frequency.—L. SCHAMES.—An account of an experimental investigation of the relation between the energy loss due to hysteresis and the speed at which the cyclic loss is accomplished and incidentally also of the dependence of permeability upon frequency. The author used a purely calorimetric method and his chief results are as follows: If the hysteresis losses are reduced to equal maximum induction, the loss is independent of the frequency so long as B does not exceed about 10,000. Upwards from that the loss of energy increases with the frequency. The demagnetization under the same conditions is independent of the frequency. The permeability decreases in weak fields as the frequency increases, and does so most rapidly at its maximum; on increasing the field strength the permeability for different frequencies approaches a constant value.—Lond. *Elec.*, May 24.

Electric Resistance and Magnetism.—E. P. ADAMS.—A theoretical paper on the effect of a transverse magnetic field on metallic resistance. The author gives a theory which is a modification of that of J. J. Thomson, based on the corpuscular hypothesis, to explain some of the experimental facts.—*Physical Review*, May.

Electrochemistry and Batteries.

New Electrolytic Alkali Works.—L. H. BAEKELAND.—A fully illustrated description of the new electrolytic alkali works of

the Development & Funding Company, at Niagara Falls, using the Townsend cell. The construction of the cell and various improvements which have recently been made, especially in the diaphragm, are described.—*Electrochem. and Met. Ind.*, June.

Metallic Calcium.—J. Escard.—A review of methods for electrolytically producing metallic calcium and of applications of calcium and its alloys.—*L'Eclairage Elec.*, May 25.

Units, Measurements and Instruments.

Interrupter.—O. Canter.—A description of a device of Ammon, intended to replace the Neef or Wagner interrupter.

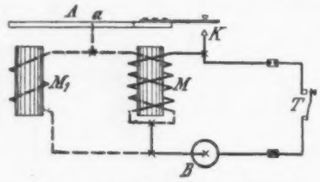


FIG. 4.—INTERRUPTER CIRCUITS.

The arrangement is shown in Fig. 4, where A is the steel plate mounted so that it can be turned around point A. B is a battery. If the switch T is closed the current magnetizes the electromagnet M which attracts the right half of A so that the contact K is closed. The current from the battery has now two other circuits at its disposal, namely through the second winding of M and through the winding of M_1. In this way the magnet M is demagnetized while M_1 is magnetized, the left arm of A is therefore attracted and the contact K is broken; and so on. There is no special adjustment necessary if only the current is sufficient. The apparatus is stated to operate absolutely sparkless. This is due to the fact that the windings of the electromagnet M are equivalent to a condenser. This construction is recommended for induction coils, in which case it is only necessary to place a secondary winding on M_1. It is not necessary then to add a condenser.—*Elek. Zeit.*, May 28.

Determining Electrolytic Resistance and Capacity.—A. H. Taylor.—If the polarization capacity is constant for small e. m. f.'s, it may be offset by an inductance in series with the electrolyte, as has been done by Wien. The objection to his method is that it is not independent of frequency, even if the electrolytic capacity be independent of frequency. The author proposes a method of attacking this problem which will allow the use of a commercial alternating current; that is, one with many high harmonics, hence of several frequencies. In regard to its behavior toward alternating currents an electrolyte, with polarizing electrodes, may be regarded as a resistance in series with a capacity, a second resistance shunting both the resistance and the capacity in some cases. The author shows that it is possible to balance this combination in a bridge by inserting a shunted inductance in the same arm with the shunted electrolyte.—*Physical Rev.*, May.

Condensers.—J. Schmidt.—The first part of an illustrated article on the construction and uses of high-tension condensers.

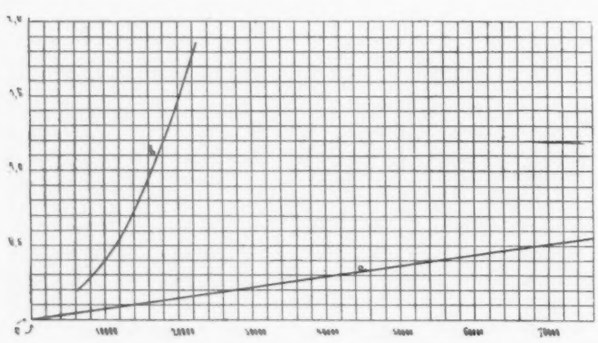


FIG. 5.—RESULTS OF CONDENSER TESTS.

A review is first given of the different forms of dielectrics used by different firms for such condensers, and the inherent disadvantages of plate condensers are pointed out. The chief point is that the dielectric in form of a plate can stand very much higher voltages near the center of the plate than near the rim. For instance, a glass plate of 0.5 mm thickness stands voltages up to 67,000 near the middle of the plate before it breaks down, while portions of the plate near the rim break down at about 11,700 volts. Tests were made with alternating current of 50 periods per second in which a certain kind of glass plate was tested both at the center part and near the rim. The results are given in Fig. 5, in which the abscissæ represent volts and the ordinates represent the thickness of the glass plate in millimeters. The curve a gives the break-down voltage near the center of the plate, and shows that the break-down voltage is proportional to the thickness of the glass. The curve b gives the break-down of the voltage near the rim. These experiments were made by Moscicki, who concludes that for the rational construction of a condenser the rim of the dielectric is the most dangerous point, so that it should be strengthened there as much as possible. Further, the extension of the rim should be reduced as much as possible. Further, any foreign body between the dielectric and the charged plates represents a danger point. For this reason it is important that the charged plates should be in close contact with the dielectric at all points of the surface. The article is to be continued.—*Elek. Anz.*, May 26.

Induction Coils.—E. W. Ehnert.—The conclusion of his illustrated paper on the theory and predetermination of induction coils. The author gives brief descriptions of various interrupters and some notes on the construction of induction coils.—*Elek. und Masch.*, May 19.

Photometer—See abstract under Lamps and Lighting.

Radiation Pyrometer.—C. H. Willson and F. Maeulen.—A fully illustrated description of the principle and operation of the Fery radiation pyrometer, which is based on the measurement of the total radiation, and of the use of a recording attachment in connection with this instrument.—*School of Mines Quarterly*, April.

Telegraphy, Telephony and Signals.

Loaded Telephone Cable.—A fully illustrated description of the telephone cable, loaded with Pupin coils, across Lake Constance. Some mechanical difficulties in the loading of the cable were to be overcome. Its resistance is the sum of that of the conductors and the Pupin coils. The stranded copper conductors have a cross-section of 1.77 sq. mm. The guaranteed resistance was 20 ohms per kilometer of double wire. The resistance of the coils was guaranteed to be 20 ohms, so that the total guaranteed resistance per kilometer was 40 ohms, while the actual resistance worked out at 33.5 ohms per kilometer. The guaranteed capacity was 0.05 mf. per kilometer; the actual value was 0.038 mf. per kilometer. The guaranteed self-induction was 0.20 henry, while the actual was 0.21 henry. The alternating current used had a frequency of 900. From this follows that the damping factor is 0.01 guaranteed or 0.0072 actual value. This is compared with three of the most recent cables of best construction, but not loaded with Pupin coils, having about the same damping factor as the loaded cable. In its properties the Lake Constance loaded cable is nearly equal to the unloaded cable from Cuxhaven to Heligoland, and the latter has a cross-section of copper of 12.6 sq. mm., while the former has only 1.77 sq. mm., or about one-seventh. It is clear that the loaded cable with its smaller cross-section is cheaper.—*Lond. Elec.*, May 24.

Telegraph Switching.—In the central telegraph office in London, a telegraph switching system is employed by which metropolitan telegraph offices can be interconnected at the central office so that telegrams originating at one metropolitan office for another metropolitan office are sent direct instead of being re-received in and retransmitted by the central office. The arrangement is described and illustrated. The article is to be concluded.—Lond. *Elec. Rev.*, May 24.

Multiple Telephony.—A. Maior.—A note recommending to make use of electric resonance in the application of high-frequency alternating currents for multiple telephony. The principle of the scheme is indicated in Fig. 6, where L_1 L_2 is the

transmission line, E_1 E_2 sources of high-frequency alternating currents, L_1 L_2 self-inductances, M_1 M_2 microphones, T_1 T_2 telephone receivers and C_1 C_2 capacities. The letters marked with the same figures belong to one tuned circuit. The tuning

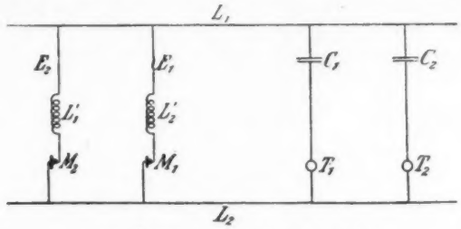


FIG. 6.—MULTIPLE TELEPHONY.

is best done by experiment. The currents produced by E_1 and E_2 must have such a high frequency that they do not produce sounds in the telephone.—*Elek. Zeit.*, May 9.

Cable Steamer.—An illustrated description of the equipment of the Ogasawara Maru, the latest Japanese cable steamer.—Lond. *Elec.*, April 12.

Miscellaneous.

Lubricating Oils.—P. F. WALKER.—An article on the properties and use of mineral lubricating oils. The author points out the need of more work in all phases of the oil question and especially in the direction of the film-forming properties. For an oil to be a good lubricant for a given service it should have the following characteristics: The least viscosity consistent with the pressure to be sustained; the ability to form thick films; readiness in forming films over metal surfaces, and power to resist rupture; a flashing temperature sufficiently high to avoid loss by evaporation, varying consistency, gumming, etc. The characteristic of most importance in a given case depends upon the conditions of pressure, and methods followed in applying the lubricant.—*Eng'ing Mag.*, June.

Training of Artisans.—C. P. C. CUMMINS.—A paper on technical training of electrical artisans. There is also an editorial on this subject.—Lond. *Elec.*, May 24.

BOOK REVIEW.

NAVIGATING THE AIR. By the Aero Club of America. New York: Doubleday, Page & Company. 259 pages; illustrated. Price, $1.50 net.

A book of which the authorship is claimed by a club is something new in literature, and in view of its subject "a flight of the imagination" might perhaps be applied to this one which bears the name of the Aero Club. As a matter of fact, the club had nothing to do with it directly, but it did a good thing in authorizing the collection of these papers and essays, and the publication committee, Messrs. Israel Ludlow, W. J. Hammer and Augustus Post have performed their task with intelligence and discrimination.

This is indeed a quite unusual and extraordinary book. fanciful perhaps in spots, but full of data and facts and summing up current work in navigating the air most satisfactorily. Since the book by Santos Dumont on his air ships, we have read nothing of the same kind with so much interest, for the 24 chapters and sections are replete with information. Some day copies of this book will bring a high price, and that day of practical realization in the new art is not so very far distant. We are sorry that electricity has still so little to do with it, especially when we remember how great was the excitement over the electric dirigible balloons of Renard and Krebs, of the French army. But in this book, Mr. Hammer, and for the matter of that Mr. Post, represents the interest that electrical engineers take in new developments, and after all the arts are closely intertwined. A very few years ago, the idea of electric locomotives on steam roads was poohpoohed, but to-day the odor of a steam locomotive in New York has practically become unknown, and the turbo generators that supply the electrics with current bear on them designation plates advising the public that the patentees reserve the rights of marine and aerial navigation. The world we can live in grows larger as we escape from the land to the water, and thence to the even more tenuous medium.

The Electric Vehicle and the Central Station.

Just how much truth lies in the expression "Competition is the life of trade," is difficult to estimate, but it does appear that if the lighting companies throughout the country had a little more competition in disposing of their product, they would be more alive to opportunities of developing their business and experimenting towards that end. For example, the electric vehicle, which for the last six years has received little encouragement and cognizance from the lighting companies in general, owes its present popularity and development almost solely to the manufacturers.

The time has come, however, when the central stations must take notice of existing conditions, for the electric vehicle is at the present day a highly successful conveyance and it has come to stay. It has a field entirely its own which lies in its use for every-day service, such as running about town, shopping, social calls, trips to and from the office and other services too numerous to mention. Its cleanliness and ever readiness for use are very desirable features for daily service, as are also the absence of intricate mechanism, and the ease with which it can be readily charged, which latter has been brought about by the use of the mercury-arc rectifier, an apparatus specially adapted for that purpose.

FIG. 1.—ELECTRIC AUTOMOBILE FOR CENTRAL STATION USE.

The desirable and practical qualities obtained from the use of the electric vehicle in connection with central station work have been amply demonstrated. The St. Paul Gas & Lighting Company, St. Paul, Minn.; The Birmingham Railway, Light & Power Company, Birmingham, Ala.; The Toledo Railway, Light & Power Company, Toledo, Ohio, are among those who have acquired that type of vehicle for their own use.

Figs. 1 and 2 give front and rear views of a Pope Waverley electric delivery wagon which the St. Paul Gas & Lighting Company is utilizing. The wagon is substantially built along symmetrical lines with plenty of load capacity. The inside is arranged with tiers of compartments on each side of the body suitable for tools and repair material necessary for light emergency work.

A feature of electric automobiles that central stations should not neglect to consider is the advertising value that is derived

from their use, especially in this case where signs with letters composed of many incandescent lamps are placed in both the rear and front of the wagon. These unique electric signs attract considerable attention both by day and night.

There is no better medium for improving the station load factor than electric vehicles, for in most cases these vehicles

FIG. 2.—REAR VIEW OF AUTOMOBILE, SHOWING ELECTRIC SIGN.

do not require charging until after eleven o'clock at night when the peak has been passed. It seems reasonable to predict that the time will come—and not very far in the future—when electric automobiles will furnish one of the most important sources of income to the electric lighting companies.

Three-Phase 7500-kw Transformers Cooled by Forced-Oil Circulation.

Recently a method of building large transformers has been devised by which an enormous amount of power may be transformed in a single unit. Such designs embody principles of insulation for high potentials and various methods of maintaining a low operating temperature by artificial cooling of the insu-

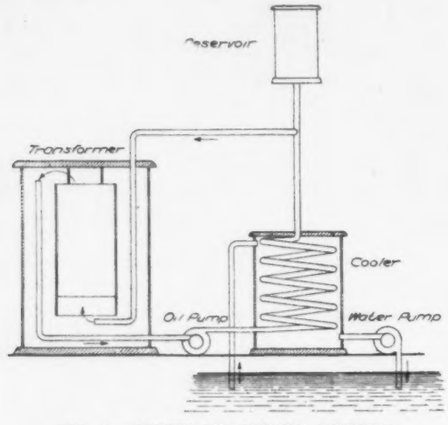


FIG. 1.—FORCED OIL COOLING CIRCUITS.

lating medium. To make the following description clear, therefore, a brief résumé of the methods of cooling transformers is of importance. With the earlier smaller lower voltage units a proper allowance of space for the natural circulation of air, sufficed for both cooling and ventilation; but with increased voltages and deeper windings, oil came to be used for an insulating and cooling medium, the natural circulation carrying the heat away from the windings. These two forms of insulation and ventilation were next improved by circulating air by motor-driven fans—as in the air-blast type of transformer—and by introducing water cooling coils in the oil-immersed type. The new method of cooling is a still further development of the water-cooled, oil-immersed type of transformer.

The water-cooled transformer was developed in order to provide the necessary insulation and cooling for large high-tension units without making the transformers as large as would have been necessary if they had been designed on the self-cooling, oil-immersed plan. In the water cooled oil immersed transformer the oil is set into continuous circulation by the cooling effect of a water coil, placed in the top of the transformer tank; the heated oil rising through ducts provided in the iron and copper structure of the transformer, gives up its heat to the water coil and descends between the transformer and the walls of the tank. The induced circulation of the oil, thus effected, secures high cooling efficacy of the oil in this transformer.

In the newly developed transformer the oil is pumped through ducts in the windings and core from an outside source. With such a scheme, transformers can be built of much larger capacities than the largest existing water-cooled transformers of the ordinary type without such increase in size as to show a

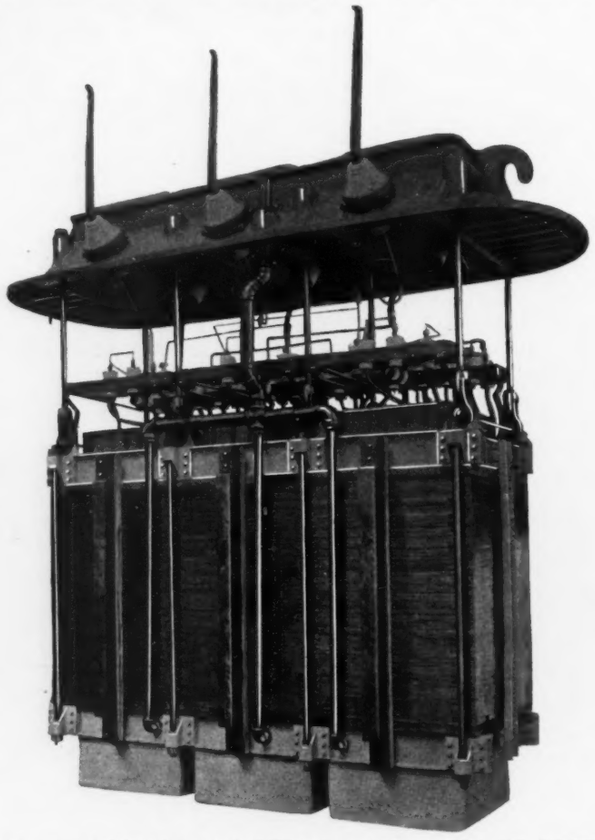


FIG. 2.—THREE-PHASE TRANSFORMER, SHOWING PIPES FOR FORCED OIL CIRCULATION.

prohibitive cost and to necessitate shipment of the transformers in parts for erection at the place of installation. The forced-oil design allows the circulation of the oil to be increased to any desired extent, thereby procuring a rapid and positive circulation which greatly increases the cooling efficacy of the oil. The forced-oil circulation is accomplished by taking the heated oil out of the transformer tank, and effecting the cooling in an "external circuit" comprising an oil cooler, pump and reservoir, as shown in the diagram of Fig. 1, thereby effecting marked reduction of size and weight of the transformer tank, of space required for oil between the transformer structure and the tank, and of the amount of oil itself. In the diagram the height of the reservoir serves to give a pressure to the oil, and pumps are provided to force the water and oil in the directions shown by the arrows. To prevent water from entering the oil

from any accidental leak which might develop in the piping or joints, the cooler is placed on the pressure side of the oil pump and on the suction side of the water pump. In hydro-electric installations, the cooling water is taken from and returned to the tail race.

The use of a pump and reservoir in the oil circulating system gives much better control of the oil circulation in the forced oil transformer than in the water-cooled type; and the heating is readily held within the limit of 35° C. temperature rise for continuous full load operation. Moreover, this method of oil circulation insures such uniform and positive cooling that much higher indicated temperatures may safely be permitted in transformers operating at moderate overloads. With ample capacity provided in oil and water circulating pumps, the transformer can without danger be called upon to carry extreme overloads under emergency conditions.

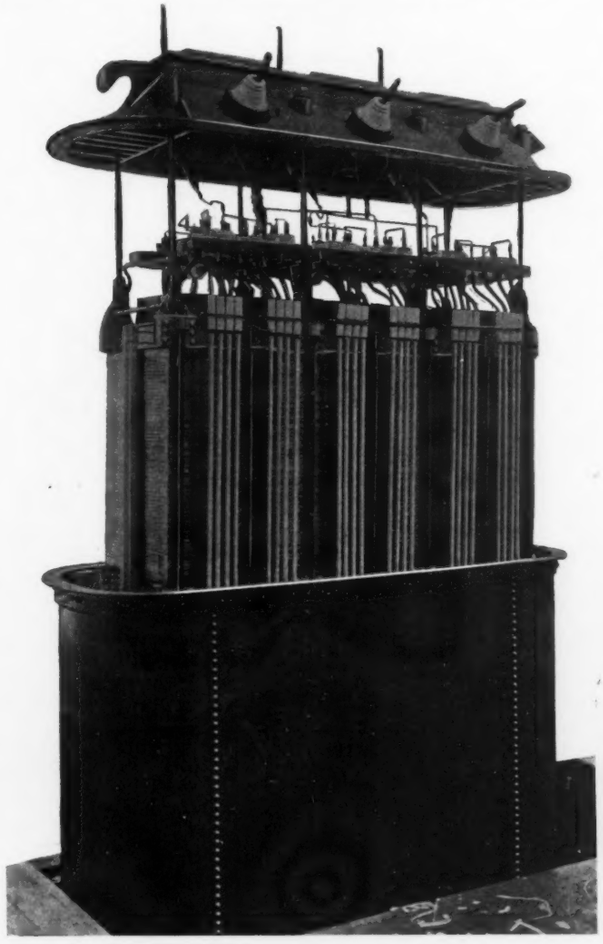


FIG. 3.—TRANSFORMER BEING LOWERED INTO CASE.

Six units of the forced oil type of transformers have recently been built by the General Electric Company for the Great Northern Power Company, Duluth, Minn., designed for a nominal capacity of 7500 kilowatts at 25 cycles, three-phase, but actually capable of carrying 10,000 kilowatts continuously at a safe temperature. The high-tension windings are adapted for 30,000 or 60,000 volts and the low-tension windings for 6600 of 13,200 volts. Three of these transformers are to be installed in the main generating station, the ultimate layout of which will call for eight units, to be supplied with current by eight 7500-kw General Electric generators. The other three transformers will be installed in the Duluth sub-station, the ultimate layout of which will comprise four units.

For the reasons set forth the new transformers are more economical in weight of active transformer material, tank and oil, and in space occupied, than they would be if they were designed with an internal water coil depended upon to induce a circulation in the cooling oil. At the same time, transformers of such very large capacity are necessarily much larger and heavier than any transformers that have been built up to present date. The Great Northern Company transformers are 14 ft. 10 in. high, 14 ft. long and 5 ft. 10 in. wide, and certain structural details, which before have not been taken into particular account, have, therefore, required special attention.

Owing to the great weight of active material in each transformer (about 65 tons) the supporting structure follows the principles of bridge design, and the transformer is supported, clear from the bottom of the tank, from the cast iron cover. See Figs. 2 and 3. In this way for convenience of inspection and installation, the cover and active material can be lifted as a unit from the containing tank.

The 7500-kw units above described are of the three-phase shell type. It is interesting to bear in mind that a three-phase unit sells for less than the same total rating of single-phase units, and where the installation contains several three-phase units the saving effected will often pay for an additional spare transformer. Whether the installation consists of one or more transformers one oil cooler, reservoir and set of pumps suffice for the entire installation. As shown in Fig. 2, the lower end of the transformer proper is completely encased, and oil is forced to pass in at the bottom and to flow upward between and through the coils and core.

It is claimed that the rating of each of these units represents the largest amount of power ever handled by a single transformer. Ten years ago 750 kilowatts was considered a large size for a transformer. The passage of a decade has thus marked a ten-fold increase in the size of this particular piece of electrical apparatus.

Improvements in Panel Boards.

The McWilliams metering panel board, made by the J. Lang Electric Company, 116 North Lincoln Street, Chicago, is illustrated in Figs. 1, 2 and 3. Fig. 1 shows the appearance of the front of the board, while Figs. 3 and 4 show the electrical connections. The special feature of value about this board is that it provides for connecting a meter to each circuit or as many circuits as may be desired to one meter, as may be needed in office and apartment building installations. This it does without complicated and slovenly cross-wire connections

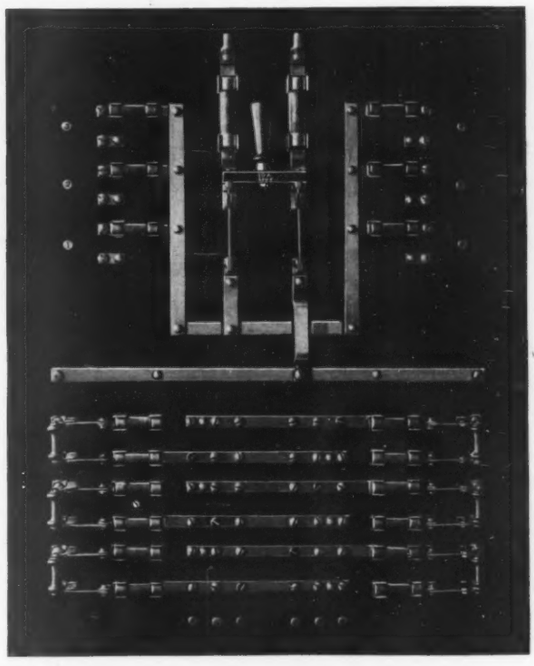


FIG. 1.—METERING PANEL BOARD.

and with a minimum of work. The panel board consists of a slate or marble panel on the front side of which are distributing bus-bars run horizontally with the necessary branch switches and fuses as seen in Fig. 1. On each side of the main switch are grouped the meter connections. These meter connections are connected through the slab with a set of bus-bars on the back of the slab. These bus-bars run vertically and cross at right angles the distributing bus-bars on the front of the board. At every other point of intersection a hole drilled through the slab permits of connecting the vertical meter bus-bar with the distributing bus-bar on the front by means of a copper screw plug. All holes not in use are filled with short dummy screws which are screwed into the bus-bars on the front of the board. The dummy screws are of a different finish from the plug con-

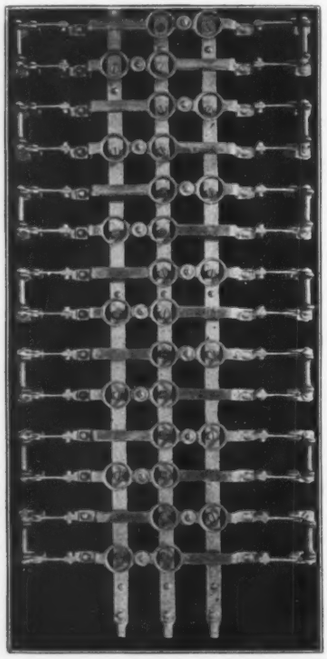
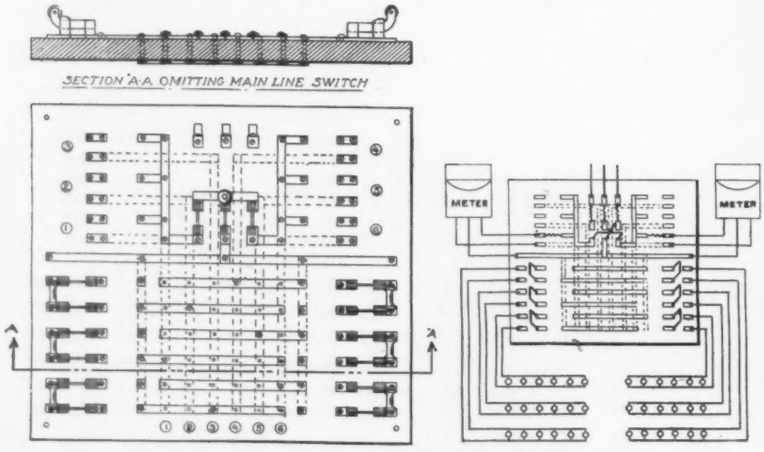


FIG. 2.—14-CIRCUIT PANEL WITH PLUG FUSES.

necting screws. A study of Figs. 3 and 4 will make the circuit connections plain.

The Universal panel board made by the same company is illustrated in Fig. 2. This panel board is adapted to take



FIGS. 3 AND 4.—CIRCUIT CONNECTIONS OF PANEL BOARDS.

standard Edison plug fuses. The construction is exceedingly simple and open. Fig. 5 shows a cross-section through one of the fuse plugs, showing a branch bar which acts also as a receptacle. The fuse plug is screwed through this branch bar directly against the main bus-bar, eliminating a great many parts necessary in the construction of the standard panel and reducing the number of connections. The arrangement of branch bars forms a protection for the main bus-bars. These Universal panel boards can be made section by section, each

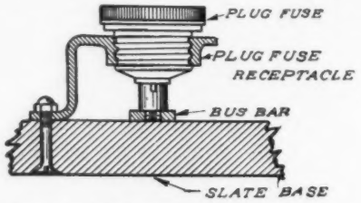


FIG. 5.—CROSS-SECTION OF FUSE PLUG.

section consisting of one two-circuit branch cut-out and switch, the bus-bars of each section being interchangeable so that they can be bolted to the adjoining section. Thus provision can be made for increase in the number of circuits if the cabinet box is not filled at first. At the same time it makes a much better-looking job than the common porcelain branch cut-out.

New Desk and Wall Telephone.

The Holtzer-Cabot Electric Company, of Brookline, Mass., has developed and placed on the market in conjunction with the Oliver Manufacturing Company, of Philadelphia, a new telephone instrument, shown in the accompanying illustrations and known as the "Flexiphone."

The instrument combines the features of a desk and wall telephone. As a desk telephone it is never in the way when not wanted, does not disturb papers, etc., on the desk, and being self-balancing, in any position, leaves the hand free for making notes. The instrument may be fastened to a flat or roll-top desk or to the wall, or mounted on a floor stand, and may be used equally well by persons of different heights, whether in a sitting or standing position. If desired, it may be arranged to serve two desks. The telephone cords are secured to the arm and therefore do not become twisted or kinked.

A main feature of the construction of the pedestal is the accessibility of all the various parts and connections. By removing a small screw in the center of the pedestal, the set can be readily taken apart and the outer casing removed, exposing the mechanism as shown in Fig. 2. The operating parts may be replaced in skeleton form without the casing, thus permitting a

FIG. 1.—FLEXIPHONE.

full view of the movement and allowing ready access for adjustment. All connections are brought out to terminals fitted into a hard rubber block which is securely fastened to the base of the pedestal frame. Hard rubber is used exclusively for insulation and pure platinum for all contact points. The contact springs are of German silver and rest against stops under ten-

sion. There are no unsoldered connections between the desk terminals and the transmitter, a point which will be instantly appreciated. The hook switch acts directly upon the contact springs in the pedestal, thus doing away with all levers and lost motion. An auxiliary steel spring supports the weight of the hook, allowing the full elasticity of the contact springs to be used in making and breaking contacts.

The pedestal is made of heavy seamless tubing with an outer shell of hard rubber. It is mounted in such a way that it

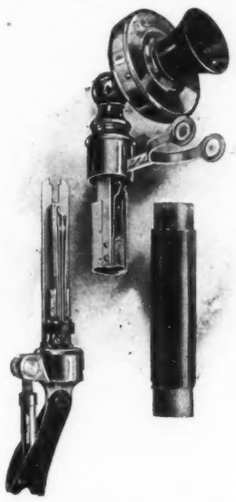
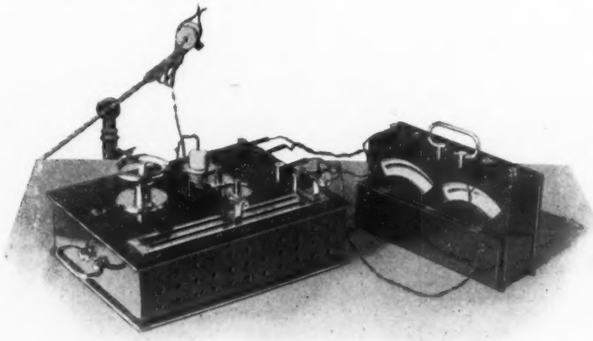


FIG. 2.—PARTS OF PEDESTAL.

always remains vertical throughout all the movements of the arm. The transmitter mouth-piece is secured at a convenient angle and the transmitter head is mounted on a swivel, which makes nearly a complete revolution in a horizontal plane. This, together with the vertical and swinging movement of the arm, gives practically any desired adjustment. The instrument is wired for common battery, for series or for bridging magneto circuits.

Direct Reading Ohm-Meter.

In the accompanying illustration is shown an outfit especially designed for the measurement of low resistances, such as the resistance of arc lamp carbons or objects of that nature. The instrument indicates directly in ohms, and can be read with great rapidity and accuracy. It consists of two elements, namely, a regulating box and a portable duplex volt-ammeter. The



DIRECT READING OHM-METER.

object whose resistance is to be measured is clamped in the holders shown on the righthand side of the regulating box and the switch on the lefthand side is turned to "on" and the righthand switch to "volts" in order to determine whether the voltage is normal within the limits provided. This voltage reading is obtained from the upper lefthand scale of the instrument. If the voltage is within normal, the resistance measurement may be made by turning the righthand switch to "ohms" and then regulating the current by means of the rheostat handle until the pointer on the righthand scale of instrument stands at 1. Then on pressing the key at the front of the regulating box the resistance may be read directly in ohms on the lower lefthand scale of the instrument. If the voltage varies either between or during tests, it is necessary merely to keep the current normal at the 1 point by means of the rheostat handle.

For the measurement of the resistance of arc lamp carbons, the ohm-meter is designed for a normal current of .1 ampere and covers a range of resistance measurement from 0 to 1.5 ohms in .01 ohm divisions. This will enable accurate readings to be made within .005 of an ohm. The testing voltage may be anything from the e. m. f. of one cell of storage battery to 600 volts. The rheostat is designed to maintain the current constant for voltage variations of 20 per cent above or 20 per cent below normal.

The ohm-meter may be used as a voltmeter and an ammeter within the scale limits specified. This instrument has recently been placed on the market by the Keystone Instrument Company, Ninth Street and Montgomery Avenue, Philadelphia, Pa.

Exhibits at the National Independent Telephone Convention.

The exhibits at the National Independent Telephone Convention at Chicago were unusually interesting and included all kinds of apparatus and material of interest to telephone men. The majority of the exhibits were made in the rooms on the sixth floor of the Auditorium Hotel adjacent to the meeting room of the association.

THE AMERICAN ELECTRIC TELEPHONE COMPANY exhibited telephone instruments and other apparatus.

THE AMERICAN SEWER PIPE COMPANY showed underground clay conduits of different kinds and capacities.

FRANK B. COOK was represented by J. M. Moore, A. Dewey, F. A. Rader and S. R. Harvey. A complete line of inside and outside telephone protective apparatus was exhibited.

THE STERLING ELECTRIC COMPANY entertained visitors in a reception room on the first floor in which was kept a supply of the company's literature concerning telephone apparatus of its manufacture.

THE UNITED BRASS MANUFACTURING COMPANY, of Cleveland, was represented by W. J. Schoenberger, secretary, and by Thomas V. Daley, who made practical demonstrations with the company's machine for making wipe joints in cable work.

W. N. MATTHEWS & BRO. exhibited Stombaugh guy anchors, Kearney cable clamps, Hargis cable splicers and Callahan cable trolleys. Practical demonstrations were made of the Hargis cable splicers. The firm was represented by Claude L. Matthews and O. R. Johann.

THE BELDEN MANUFACTURING COMPANY exhibited wire for various usues including magnet wire, bare and tinned copper wire and office and annunciator wire. The company makes a specialty of winding coils and several coils of its manufacture were exhibited. N. B. Parsons, vice-president, J. H. Lendi and J. C. Belden were in attendance.

THE AUTOMATIC ELECTRIC COMPANY had installed in one of the rooms of the suite occupied by the company a working exhibit consisting of a 100-line unit of common battery automatic switchboard type with 12 telephones connected. The company also exhibited a combination wire chief and trouble clerk's desk recently built for the Home Telephone Company, of Champaign and Urbana, Ill.; also a duplicate set four-frequency harmonic converter built for the Montana Independent Telephone Company, Butte, Mont. All of these pieces were working exhibits. The company was represented by C. L. Fisher, sales manager; F. L. Middleton, assistant sales manager; H. H. Woodworth, advertising manager; J. A. Russell, P. J. Eubanks and J. E. Fisher of the sales department, and Wm. Hannan and J. S. Engh of the engineering department.

N. E. L. A. Convention Exhibits.

Descriptions of the exhibits made by associate members at the National Electric Light Association's Washington convention were published in these columns last week. These included all the exhibits in place at the time of going to press. The following is a list of exhibits subsequently made, together with notes of commercial interest:

H. T. Paiste Company, of Philadelphia, was represented by Mr. H. T. Paiste.

Speer Carbon Company, of St. Marys, Pa., was represented by John S. Speer.

Electric Service Supplies Company was represented by Mr. W. A. Armstrong.

Bryan-Marsh Company was represented by G. G. Lockwood and Mr. Haughton.

The D & W Fuse Company, of Providence, R. I., was represented by Mr. W. S. Sisson.

Driver-Harris Wire Company was represented by Frank Driver and Arlington Bensel.

Shelby Electric Company, Shelby, Ohio, was represented by W. N. Macbeth, of Philadelphia.

Seaboard Electric Company, of Baltimore, Md., was represented by Mr. Arthur L. Bosley.

The Anchor Lamp Company, of New York, had its interests well looked after by Mr. R. W. Morgan.

Household Electric Appliance Company, of Philadelphia, Pa., was represented by Mr. J. Mustard.

The Tipless Lamp Company, of New York, had in attendance Messrs. H. J. Jaeger and R. S. Carrick.

American Steel & Wire Company sent Messrs. F. A. Keys and R. K. Sheppard to represent it at the convention.

Dodge & Day, of Philadelphia, Pa., were represented in the person of their New York manager, Mr. R. T. Lozier.

The Jaeger Miniature Lamp Manufacturing Company, of New York, was well represented by Charles T. Jaeger.

The Chase-Shawmut Company, Newburyport, Mass., was seen and heard through Messrs. Moore and Masterson.

Harry Adams shook hands as cordially as ever with his army of friends and talked the R. B. Corey line of specialties.

Doubleday-Hill Electric Company, of Pittsburg, Pa., was represented by C. P. Hill, the president of the company.

Columbia Incandescent Lamp Company, of St. Louis, was represented by A. C. Garrison, the president of the company.

Electrical Testing Laboratories, of New York, sent its assistant manager, Mr. P. S. Millar, to represent it at the convention.

The Dale Company, New York, manufacturer of electrical and combination fixtures, was represented by its president, J. H. Dale.

De La Vergne Machine Company, of New York, was represented by H. P. Hill, sales engineer of the gas engine department.

Standard Electrical Manufacturing Company, of Niles, Ohio, sent its sales manager, Mr. H. H. Albert, to look after its interests.

J. A. Roebling's Sons Company, of Trenton, N. J., was represented by the genial H. L. Shippy and by Messrs. G. W. Swan and A. Mann.

The Sterling Electrical Manufacturing Company, of Warren, Ohio, was represented by W. A. Coale, Glenn Webster and Mr. Ramey.

The General Incandescent Lamp Company, of Cleveland, Ohio, sent Mr. H. C. Rice, its manager, to look after its interests at the convention.

H. C. Roberts Electric Supply Company, of Philadelphia, Pa., sent Mr. J. A. Vaughan to pay its respects to electric lighting men at the convention.

The Holyoke Machine Company, of Worcester, Mass., sent its greetings through Mr. W. D. White, who said plenty of nice things for its improved governor.

The Western Electric Company's superintendent of construction, Mr. E. S. Keefer, and the National Electric Light Association's Convention are inseparable.

Adams-Bagnall Electric Company, of Cleveland, Ohio, maker of the well-known A-B arc lamps, was represented by G. A. Thomson, its Eastern sales manager.

Benjamin Electric Manufacturing Company, maker of wireless clusters and lighting specialties, was represented by Messrs. H. E. Watson and B. G. Kodibanoof.

The Buckeye Electric Company, of Cleveland, Ohio, was ably represented in the person of its manager, Mr. L. P. Sawyer, and also in Mr. Smith, of the Philadelphia office.

Phoenix Glass Company sent its vice-president, A. H. Patterson, to represent it and to interest central station managers in its line of glassware for electric lighting systems.

The Condit Electrical Manufacturing Company, of Boston, Mass., had its well-known circuit breakers well spoken for by S. B. Condit, Jr., general manager of the company.

The National Metal Moulding Company took excellent care of visitors through H. B. Kirkland, assistant general sales manager, and C. F. Boynton, of the New York office.

American Circular Loom Company, of Chelsea, Mass., the well-known manufacturer of "Circular Loom" and "Electroduct," was represented by Oscar Hoppe, Alexander Henderson and A. T. Clark.

The Holophane Company made no exhibit; in fact, it needed none, for its famous reflectors were everywhere in evidence. Mr. V. R. Lansingh, the engineer and general manager of the company, was present during the convention.

The India Rubber & Gutta Percha Insulating Company, Yonkers, N. Y., the manufacturer of the well-known Habirshaw wires, was represented by its general sales manager, Mr. J. B. Olson, and R. R. Satterlee, the secretary of the company.

Pettingell-Andrews Company, of Boston, Mass., besides showing a very complete line of central station supplies, had as a feature its remote control switch. This was shown in operation in the company's booth under the direction of Mr. W. J. Keenan, sales manager of the company, and Mr. C. E. Palmer, electrical engineer.

The Brunswick Refrigerating Company, New Brunswick, N. J., had on exhibition in the office of the Potomac Electric Power Company one of its automatic household, electrically-driven, refrigerating and ice making machines. Mr. E. B. Hewitt was in charge of the demonstration, which proved of interest to many visitors.

Mr. Julius Auerbach, president of the Electrical Accessaries Company, New York, was one of the busiest men at the convention. This is easily understood, as this company was the first to introduce the tungsten lamp in this country, and every central station manager in attendance was naturally desirous of knowing all about the lamp. As a consequence, many orders were booked, in spite of the fact that the general impression seemed to be that the tungsten lamp had not yet been offered for sale.

United Brass Manufacturing Company, of Cleveland, Ohio, had an exhibition in the National Hotel, where several sizes of Corcoran wipe joint machines were shown in operation. This machine as adapted to telephone, telegraph and electric light companies presents a solution of one of the vexed problems of construction work—that of getting satisfactory wiped lead joints at the junction of cables. The machine not only makes a better joint with less solder, but utilizes a solder rich in tin which cannot be worked by hand and which results in a stronger joint than is possible by the older methods.

H. W. Johns-Manville Company had a double booth in charge of J. W. Perry, manager of the electrical department. Assisting him was a staff composed of H. M. Voorhis, S. G. Meek, W. F. Little, H. M. Frantz, R. R. Braggins, E. F. Quirk, A. F. Saylor, G. U. G. Holman, C. T. Bishop, R. C. Cole, E. C. Sawyer and J. E. Meek. A complete line of "Noark" fuses and fittings was on exhibition, together with several Victor combination meters. The company distributed samples of J-M friction tape. A feature of the exhibit was the "transite" asbestos fireproof doors for high-tension transformers and switches.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Reports of trade still reflect backwardness on account of the unreasonable weather, and distribution of spring merchandise and progress of crops were correspondingly retarded. Transactions during the few days of seasonable weather thus far indicate that settled warm weather will bring out much business, but so much time has been lost that few merchants anticipate a normal volume in the aggregate and large stocks will be carried over or sacrificed at bargain sales. On the farms the situation is critical, but a few weeks of high temperature will make the outlook much brighter, except that extensive replanting adds heavily to the cost of the crops. Wholesale trade in fall and winter goods is brisk, large duplicate purchases because of the cold spring having depleted stocks in the hands of retailers. Manufacturing plants are operating at full capacity in most industries, cotton mills making remarkably favorable returns in view of the weather and cost of raw material. Despatches from leading cities indicate that the business situation is much more satisfactory at points in the West than in the East or South, especially favorable conditions prevailing at Seattle and Portland on the Pacific coast. Few serious labor struggles are now in progress, and more advances in New England mills extend the benefits of higher wages to 200,000 hands. Except for an increase in the number of failures at New York City, the May statistics of failures make a fairly good comparison with a year ago. There were 755 failures reported in *Bradstreet's* for that month, with liabilities of $10,542,895, an increase of 8.6 per cent in the number and 4.3 per cent in the failure damage as compared with May a year ago. Two-thirds of the excess in number of failures over a year ago is found in New York City. There are more failures in New England, the middle group, the Northwest and the far West, but fewer in the West and South. The number of failures for the week ending June 6 was 155, against 142 in the week previous and 162 in the corresponding week last year. Railway earnings returns for May point to very large gains in gross receipts, and advices are that car congestion has been largely relieved, but increased cost of operation has cut April net returns very heavily. Visible wheat supplies in this country and Canada decrease very slowly. This is probably due to higher prices and improved transportation facilities allowing a larger movement from the farms. Thus, in the United States receipts at primary points for five weeks ending with June 1 are more than double those of a year ago in the same period. Decreases in visible supplies are, in fact, confined almost entirely to Canada. Pig iron markets are very quiet, but furnaces are sold so far ahead that producers are not uneasy over the absence of business. New business in steel rails is of moderate proportions. Demand for structural materials is only fair. In the West demand for steel bars is still heavy. Electrolytic and casting grades of copper were easier in price and domestic business was light. Lake closed at 24¼; electrolytic at 23 and casting stock at 22.

LIGHTING IN NEW YORK.—The Long Acre Light & Power Company which recently secured permission under a decision of the Court of Appeals to use the conduits of the Consolidated Telegraph & Electrical Subway Company, has bought a site for its first power house at 120th Street and the East River. It is the old Harlem Hospital property. The price paid was $400,000. The property comprises about 16 lots, having a frontage of 400 feet on the north side of 120th Street and 100 feet on the river. The plant, which is to be six stories in height, is to cost $6,000,000. According to Mr. Walter H. Knight, chief engineer of the Long Acre Company, his company has already contracted for steam turbines of the largest units yet built. The company also owns the block on Second Avenue between Forty-Seventh and Forty-Eighth Streets, where it will have a complete electric light plant in service, and is building another plant on the waterfront in Brooklyn, at Fulton and Furman Streets. Mr. Sheehan, at the head of the enterprise, has authorized contracts, it is said, to sell this electricity at the rate of three cents a kilowatt-hour. According to the *Times*, the plans of the Long Acre Electric Light & Power Company, which aims to fight the monopoly of the Edison Company in New York, were brought one step nearer actuality last week by the purchase of the old Harlem Hospital site, a plot fronting about 400 feet on the north side of 120th Street and 100 feet on the East River, where, as has already been announced, the company has planned to build a large power plant to supply current for the uptown service it promises to inaugurate. The Long Acre Company, which is a subsidiary of the Manhattan Transit Company, was recently sustained by the Supreme Court in its claim to rights in the electric conduits under Forty-second Street. This decision, the company's officers assert, will give it the same rights in other parts of the city and enable it to sell electric current. Options on the Harlem River site were obtained some time ago, and the deal was practically closed immediately after the announcement of the decision of the court favorable to the company. The price paid to James T. Blandford for the site is said to have been $400,000. Announcement was also made from Albany last week that an amended certificate of incorporation of the Long Acre Electric Light & Power Company, extending the limits of its original charter throughout the boroughs of Manhattan and the Bronx, had been filed with the Secretary of State at Albany. This announcement caused lively trading on the curb in the stock of the Manhattan Transit Company, which owns the Long Acre company and is controlled by John C. Sheehan. Along with this news from Albany it was stated that Mr. Sheehan has made a contract with the United States Independent Telephone Company to connect his proposed telephone service here in New York with the interstate lines of the Independent company, and that $6,000,000 of the stock of the latter company has already been put into the hands of five trustees to hold it ready to be turned over to Mr. Sheehan as soon as his part of the contract has been carried out.

ELECTRICAL SUPPLIES FOR NAVY.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., June 25, 1907, for electrical supplies, etc., as follows: 14,400 feet of miscellaneous cable, 2000 incandescent lamps and miscellaneous electrical supplies to be delivered at the New York Navy Yard (Schedule 932); miscellaneous electrical supplies (Schedule 951) for Annapolis Navy Yard; 4 turret-turning equipments, complete (Schedule 952), to be delivered at the New York Navy Yard. Also the following machine tools, to be delivered at the navy yards named: 1 electric motor (Schedule 921), League Island, Pa.; 1 15-hp electric motor (Schedule 937), Norfolk, Va.; 1 electric motor (Schedule 941), Washington, D. C.; 1 electric-driven pump (Schedule 921), Boston, Mass.; 1 triplex electric pump (Schedule 920), Norfolk, Va. Interested bidders should give schedule numbers.

WORK AT BRISTOL, TENN.—The organization of a distributing electric light and power company has been completed with the following officers: J. D. Mitchell, president; W. L. Halstead and J. B. Baumgardner, vice-presidents; Theodore Swann, secretary and treasurer. The company proposes to purchase from a developing company financed by Charles Hall Davis and associates of Petersburg and New York, the electric power which will be developed at Fish Dam on the Holston River ten miles from Bristol. Charles Hansell & Company, of New York, are the engineers in charge of the work. The company proposes to build a 60-ft. dam and develop 4000 horsepower.

DODGE & DAY, engineers and contractors, Philadelphia, Pa., have commenced work on an extension of the York (Pa.) Street Railway system, from York to Hanover. They have a large force of men working and rapid progress is being made. The same firm designed and is constructing the new buildings of S. L. Allen & Company, Fifth and Glenwood Avenues. These buildings are being constructed entirely of re-inforced concrete.

WESTERN IRRIGATION.—It is stated that negotiations have been completed by J. G. White & Company to build the largest dam in the world at a point nine miles northwest of Denver, to be known as the Standley dam. With the auxiliary system so far projected it will cost upward of $4,000,000. It will have a length of nearly a mile and a quarter, a height of 150 feet, and will contain 10,000,000 cubic yards of material. The dam will be used for irrigation purposes, and is the result of the consolidation of several irrigation companies in Colorado. By means of it 5,000,000,000 cubic feet of water will be impounded, a capacity sufficient for the regular irrigation of more than 100,000 acres of land. The flow of five rivers will be confined in the reservoir which the dam will form. The financing of the proposition has been arranged for. It includes the formation of a corporation with approximately $10,000,000 capital stock. It is obvious that the impounded water can develop a large amount of electrical energy.

ELECTRIC MACHINERY CO.—This Minneapolis concern reports that it has just closed a contract with the Valdez Electric Light & Power Company, of Valdez, Alaska, for one of its 150-kw revolving field alternators. It has also just closed a contract with the Cavite Electric Light & Power Company, Cavite, Philippine Islands, for a 150-kw equipment, consisting of a 3-phase revolving field alternator of that capacity, together with engine, transformers, switchboard equipment, etc. The demand for the company's alternating-current machinery is steadily increasing in all sections, and these two orders have been received during the past 30 days. The Philippine order was received by cable with a liberal cash payment accompanying it. The company has just established an agency in Japan and China, which gives promise of being a very satisfactory arrangement.

LAMP BIDS.—Bids will be received by W. S. Patten, assistant quartermaster, U. S. A., 39 Whitehall Street, New York City, until June 15, for 75,000 incandescent lamps for the quartermaster's department; also alternate proposals for 270,000 incandescent lamps to be delivered to the Treasury and Quartermaster's Departments, Library of Congress and Government Printing Office, Washington.

ARMORY LIGHTING.—Bids will be received until June 21 at the office of George B. McClellan, Mayor, New York City, chairman Armory Board, for furnishing and installing electric lighting fixtures, etc., in the Twelfth Regiment Armory, borough of Manhattan. Robinson & Knust, 164 Fifth Avenue, Manhattan, are the architects.

MOTOR FOR PANAMA.—Bids will be received until June 21 by D. W. Ross, general purchasing officer, Isthmian Canal Commission, Washington, D. C., for furnishing an electric motor, etc., as per Circular 370.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was strong with substantial advances due to covering of shorts caused mainly by more favorable crop advices and the absence of reported trouble in the foreign markets. Trading continued to be mainly centered in a few leading railroad stocks, Union Pacific being conspicuous. On Monday New York Central sold at 108¼, which is the lowest price that stock has touched since 1898. Dividend increases by industrial companies like American Car & Foundry and American Smelting common were regarded favorably. The news from Albany that the five-cent Coney Island fare bill had probably been killed had a good influence upon Brooklyn Rapid Transit, while the fact that the Interborough directors declared the regular 2½ per cent quarterly dividend on its stock, about which action there had been some uncertainty, was productive of a good tone in the traction properties. Some effect was produced on Pennsylvania shares by the news that its management had decided to place all fares on a two-cent basis. The announcement of a $21,000,000 issue of new stock at par by the American Bell Telephone Company was of little interest to the New York market, but, on the whole, seemed to be better received than recent announcements of new capital creations although the announcement made the stock waver. Electric stocks were stronger and most of them closed at advanced prices, Brooklyn Rapid Transit making the greatest gain—five points. General Electric rights closed at 1½, a net gain of ⅛-point. Metropolitan Street Railway declined eight points. The market at the close of the week was strong and generally higher in the face of further large gold export engagements. The curb market showed more firmness in sympathy with the trend of the general market. The greatest advance was in United Copper, which rose more than 10 points on sales of about 25,000 shares. Other coppers were also higher. American Telephone & Telegraph rights to the new stock were dealt in for the first time, advancing from below 30 to above 50. Following are the closing quotations of June 11:

NEW YORK.

	June 4	June 11		June 4	June 11
Allis-Chalmers Co.	10¾	10¼	General Electric	138	140
Allis-Chalmers Co. pfd.	31	31	Hudson River Tel.	—	—
Am. Dist. Tel.	—	—	Interborough Met. Com.	16¼	16
American Locomotive	58¼	57¾	Interborough Met. pfd.	46¾	46
Amer. Locomotive pfd.	102	102	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos pfd.	—	—
American Tel. & Tel.	—	—	Marconi Tel.	—	—
Brooklyn Rapid Transit.	50¾	53½	Metropolitan St. Ry.	—	—
Electric Boat	33	33	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	80	80	Western Union Tel.	78½	80
Electric Vehicle	—	—	Westinghouse com.	142	142½
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	June 4	June 11		June 4	June 11
American Tel. & Tel.	108	108¾	Mass. Elec. Ry. pfd.	57½	56
Cumberland Telephone	106½	106⅜	Mexican Telephone	5	—
Edison Elec. Illum.	208	208	New England Telep.	113	112
General Electric	139	—	Western Tel. & Tel.	—	—
Mass. Elec. Ry.	—	—	West. Tel. & Tel. pfd.	—	—

PHILADELPHIA.

	June 4	June 11		June 4	June 11
American Railways	48	48	Phila. Electric	7¾	8⅛
Elec. Co. of America	9⅞	9½	Phila. Rapid Transit	22¾	23½
Elec. Storage Battery	49	48	Phila. Traction	91½	91⅞
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	June 4	June 11		June 4	June 11
Chicago City Ry.	170⅛	150	National Carbon	71	70
Chicago Edison	136	—	National Carbon pfd.	110	110
Chicago Subway	18½	20¼	Union Traction	—	—
Chicago Tel. Co.	—	—	Union Traction pfd.	—	17
Metropolitan Elec. com.	23	22			

MONTREAL ANNUAL REPORT.—The Montreal Light, Heat & Power Company's report for the year ended April 30, 1907, compares as follows:

	1907.	1906.	1905.
Gross	$3,453,490	$3,186,103	$2,901,264
Expenses	1,529,270	1,431,198	1,302,122
Net	$1,924,220	$1,754,905	$1,599,142
Interest	483,638	476,419	470,353
Surplus	$1,440,582	$1,278,486	$1,128,789
Dividends	850,000	680,000	680,000
Year's surplus	$590,582	$598,486	$448,789

The surplus applicable to dividends, $1,440,582, is equal to 8.47 per cent earned on the $17,000,000 capital stock. President H. S. Holt says as follows: "There have been declared out of the year's net profits four quarterly dividends of 1¾ per cent each, amounting to $850,000, leaving a balance of $590,582, which, added to the surplus of $901,158 brought forward from last year, brings the surplus to $1,491,740, out of which appropriations have been made to the amount of $386,892, as follows: Depreciation, renewals, etc., $255,000; insurance fund, $56,892; contingent account, $50,000; suspense account, $25,000. There were issued during the year $447,000 of the company's 4½ per cent bonds to repay the company 75 per cent of the expenditure made during the year for extensions in the gas and electric departments. Owing to the depressed condition of the bond market throughout the year, the sale of these bonds has been withheld, and are at present in the company's treasury. The company has added to its steam plant at Queen Street station a 2000-hp turbine unit, and now has available at this and its other steam stations a total capacity of 8000 horse-power. The increase in the company's business continues to be most satisfactory, the following additions having been made during the year: Electric department, incandescent lamps connected, 41,655; commercial arc lamps, 266; street lamps, 33; power (horsepower), 4884. Gas department: Meters installed, 5747; stoves, generators, etc., installed, 2501.

LACLEDE POWER SALE.—As already noted, final payments by E. W. Clark, of Philadelphia, have completed the sale of the Laclede Power Company, St. Louis, properties and it is expected that a reorganization meeting will be held within a few days when a new president and officers will be chosen. The Philadelphia syndicate has gained control of most of the public utilities in East St. Louis and other suburban towns and the Alton, Granite City & East St. Louis Traction Company. There had been considerable speculation as to whether the Laclede Company was in reality purchased by the Clark syndicate or by the North American Company.

DIVIDENDS.—Directors of the South Side Elevated Company, of Chicago, have declared a regular quarterly dividend of 1 per cent, payable June 30. Directors of the Rochester Railway & Light Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable June 1. Directors of the Chicago City Railway have declared a quarterly dividend of 1½ per cent, reducing the annual rate from 9 per cent to 6 per cent, payable June 29. The directors of the Mackay Companies have declared the regular quarterly dividends of 1 per cent on the preferred stock and 1 per cent on the common, payable July 1. Directors of the Interborough Rapid Transit Company have declared the regular quarterly dividend of 2¼ per cent, payable July 1 to holders of stock and voting trust certificates of record June 17. Directors of the American Tel. & Tel. Company have declared a regular quarterly dividend of $2, payable July 15. The trustees of Massachusetts Lighting Companies have declared a regular quarterly dividend of 1¼ per cent, payable July 15. Directors of J. G. White & Co., have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable July 1. Directors of the Ingersoll-Rand Company have declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable July 1. Directors of the Union Traction Company have declared a regular dividend of 1¼ per cent, payable July 1. Directors of the Toronto Railway have declared the regular quarterly dividend of 1½ per cent, payable July 2. Directors of General Electric have declared the regular quarterly dividend of two per cent, payable July 15 to stockholders of record June 15. Directors of the Lynchburg (Va.) Traction & Light Company have declared the regular quarterly dividend of 1½ per cent, payable June 15. Directors of the Continental Passenger Railway Company, of Philadelphia, have declared a semi-annual dividend of $3, payable June 30. Directors of the Portland (Ore.) Railway, Light & Power Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 1. Directors of the Puget Sound Electric Railway, of Seattle, have declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable July 1.

BELL TELEPHONE STOCK.—The directors of the American Telephone & Telegraph Company authorized last week an issue of $21,000,000 new stock. President T. W. Vail says in regard to this: "The great increase in the telephone business of the past few years, unlooked for in great measure and in a big sense considered only temporary, has made great demands in every way upon all the resources of the various companies. While this was to a great extent impossible to anticipate so far as the past is concerned, it would not be wise or for the interest of the company to fail to profit by its experience. The policy of the company should be to anticipate requirements, rather than let requirements force action upon the company. Ample financial resources should be provided in advance of immediate demands, and it seems wise under all conditions to ask the shareholders to make the necessary provision. While these demands still continue large, and must be met, it is for a much better class of service, yielding more adequate returns, utilizing the construction work already completed and making the demands upon the company for money for new construction very much less than last year. So far as the work of the current year is concerned, the company has ample resources to provide for all contemplated expenditures without any difficulty whatever and without increasing liabilities beyond those already incurred by the sale of the convertible bonds. So far as the general outlook is concerned it was never brighter. Conditions are becoming more favorable in all quarters, business is improving and returns are more satisfactory. The balance of earnings of the American Tel. & Tel. Company for the five months ended May 31 is nearly $600,000 more than for the same months last year and the surplus for the first five months of this year is quite sufficient to pay a full year's dividend of the proposed new issue of stock, which will make no considerable demands on the present year." Stockholders are entitled to one share of new stock for every six shares held.

MILLIKEN BROTHERS RECEIVERSHIP.—Milliken Brothers, incorporated, owners of the only structural steel plant in New York City, and important structural steel contractors, doing business in several foreign countries as well as in this country, failed on June 10, with total estimated liabilities of $6,500,000, including the three-million-dollar issue of bonds put out last year, the proceeds of which were used in the construction of a structural steel plant on Staten Island. The primary cause of the failure was the investment in the Staten Island plant of about $1,350,000 more than had been provided for this specific purpose. In this way the company's working capital was, to a large extent, diverted to other uses, and the management of the company was unable to swing the very large business which it has developed during the last few years. The new plant was to have cost $3,500,000, but has actually cost about $4,850,000, and the $3,000,000 bond issue to pay for it was floated by J. S. Bache & Co. The creditors petitioning for the receivership include John A. Roebling's Sons Company, $2,950; Niles, Bement & Pond, $11,628, and Robert W. Hunt & Company, $923. The receiver is Mr. W. N. Cromwell, and the assets are placed in excess of $8,000,000. The firm was established in the fifties by the father of Foster and E. W. Milliken, the latter of whom died in November, 1906.

ST. LOUIS LIGHTING.—It is stated on apparently good authority that the general purpose back of the quo warranto proceedings instituted May 18 by Circuit Attorney Sager, of St. Louis, against the Union Electric Light & Power Company, asking the forfeiture of the company's charter and penalties to the amount of $134,800, is to secure the equitable operation of all public utilities. It is not the purpose, according to the circuit attorney, to take the company's charter away permanently. If the circuit attorney is successful in the case, it is the intention to offer the company a return of its charter upon the condition that it file a bond guaranteeing the future operation of the company in strict compliance with the laws of the state and upon an equitable basis to all concerned, and further agree to pay to the city a reasonable compensation for its franchise rights. Many St. Louis interests will be affected by the suit, as North American stock and securities are largely held by St. Louis financiers, promoters and brokers.

GENERAL ELECTRIC STOCK.—It is stated by the *Wall Street Journal* that according to a representative of the General Electric Company, practically the entire issue of $13,000,000 5 per cent 10-year debenture bonds, equal to 20 per cent of the present holdings of stock will be subscribed for by the shareholders. The first payment of 50 per cent falls due on July 20, 1907, and the second payment of 50 per cent on January 20, 1908, stockholders having the privilege of making the full payment on July 20. The increase in the business of the General Electric Company in May corresponded with the increase reported in the first quarter of the year. In January, February and March, orders received aggregated $8,602,962, as compared with $14,639,997 in the corresponding period of last year. Orders received from January 1 to May 31 ran very close to $25,000,000 in valuation.

NEW ATLANTA CONTRACT.—The bid of the Georgia Railway & Electric Company for electric lights for Atlanta for five years has been accepted by the council committee. At present the city is paying $75 each for arc lights and $33.75 each for incandescent lights. Under the new scale the saving to the city for five years will be about $105,260. Private customers will not be charged for commercial or private purposes more than 10 cents per kilowatt-hour for light and 6 cents per kilowatt-hour for power. No representative of the North Georgia Electric Company was present and that company made no additional bid. The contract will go into effect eleven months from date.

CHICAGO SUBWAY LOAN.—Chicago subway and tunnel interests have recently borrowed $4,000,000 more at 6 per cent for three years, making $9,000,000 borrowed in the past three years for the expansion of its business. It is probable that Mr. Armour, who is the largest stockholder and one of the greatest believers in the future of this property, will become the financial head of the enterprise. Five more miles of tunnel are being built and the company must progress with the progress of Chicago as large business houses are now being built on the north side of the Chicago River.

CINCINNATI CAPITALIZATION.—The capital stock of the Union Light, Heat & Power Company has been reduced from $1,500,000 to $500,000. An amendment has also been made in the articles of incorporation to the effect that the indebtedness shall never exceed four times the capital stock. These are details that are being carried out in the financial organization to comply with changes that have been decided upon. Of the capital stock $1,000,000 is to be retired. This is a subsidiary company to the Cincinnati, Newport & Covington Light & Traction Company.

WESTINGHOUSE FIGURES.—The Westinghouse Electric & Manufacturing Company shows that for the year ended March 31 last its orders aggregated $34,170,647; shipments, $29,189,844, and collections, $30,549,894. For the six years ended March 31 last orders aggregated $131,638,432; shipments, $128,736,491, and collections, $132,111,001. These indicate that the business of the Westinghouse Electric & Manufacturing Company is being conducted on a strictly cash basis. The policy of the management of sales of the Westinghouse Electric & Manufacturing Company is illustrated by the following figures of orders, shipments and collections for the six years ending March 31 last, which figures, however, do not include those of the subsidiaries:

	Orders.	Shipments.	Collections.
1906-7	$34,170,647	$29,189,844	$30,549,894
1905-6	24,938,631	21,059,249	21,649,184
1904-5	16,570,617	18,069,862	20,546,478
1903-4	18,509,054	21,122,646	21,872,228
1902-3	19,522,144	21,490,708	20,445,443
1901-2	17,927,339	17,804,182	16,947,774
Totals	$131,638,432	$128,736,491	$132,111,001

The deductions from the above shipments by reason of bad debts for the six years were about one-tenth of 1 per cent. It has been the policy of the company not to involve itself directly or indirectly during these years in any underwritings or in the taking of securities as part payment for apparatus supplied, except when such securities could be promptly disposed of and the proceeds turned into cash. The *Wall Street Journal* has the subjoined statement as to Westinghouse business. The following is a consolidated preliminary statement of income of the Westinghouse Electric and auxiliary companies for the month of April:

Manufacturing profit	$570,990
Miscellaneous income	112,920
Total income for month	$683,910
Less interest on bonds and debentures, miscellaneous interest, depreciation, etc.	256,989
Net credit to surplus	$426,921

These figures show a manufacturing profit slightly above 20 per cent on the shipments, or nearly 7 per cent better than the average for the year ended March 31, 1907. For the month of May preliminary figures show the shipments to have been $3,880,000, the largest in the history of the company. During the past several months the company has been selling its product at higher prices and has refused to accept orders for from two to three million dollars' worth of special work which was considered undesirable in respect to prices and interferences with regular production, in order that the company's manufacturing profit might compare favorably with that of the Westinghouse Air Brake Company, Union Switch & Signal Company, United States Steel and other important manufacturing companies. The new orders received by the company for the month of May exceed $4,225,000, nearly half a million dollars more than the shipments for the month. It is believed that the increased facilities which are being provided will meet this increased demand upon the company for its apparatus.

CHICAGO AIR LINE.—Judge Windes, at Chicago, has required a bond of $5,000 to be given by the Chicago-New York Electric Air Line Railroad Company to indemnify Theodore Nemoyer and other stockholders in a suit begun by them against the company. The bond was offered by the defendants in lieu of the appointment of a receiver and the granting of an injunction to restrain certain acts complained of by Nemoyer. Ira C. Wood, counsel for Alexander C. Miller, the Air Line Company and other defendants, said that Nemoyer was not a stockholder. Nemoyer filed suit to prevent the fulfillment of a contract entered into between the Air Line Company officers and those of the Co-operative Construction Company, which had agreed to build the road for the stock issue of the former concern. Joseph Holt, W. G. Gebhardt and others who claim stock in the company, filed an affidavit setting forth allegations similar to those of Nemoyer. Certain sections of this line are said to have been completed and others begun.

LIGHTING PLANT EARNINGS.—March reports are made of several of the plants operated by the Stone & Webster Corporation. The Houghton County (Mich.) Electric Light Company reports gross earnings of $18,448 as compared with $18,320 in 1906; the Lowell (Mass.) Electric Light Corporation, $24,187 as compared with $23,144; the Minneapolis General Electric Company, $73,111 as compared with $63,711; the Fall River (Mass.) Gas Works Company, $28,183 as compared with $26,559; the Cape Breton Electric Company, Ltd., $14,830 as compared with $17,222; the Edison Electric Illuminating Company, of Brockton, Mass., $14,607 as compared with $12,197. Although the Cape Breton showing is poor, the twelve months' report is good, the total reaching $254,164 as compared with $234,389, and the net $96,575 as compared with $82,298.

CHICAGO EARNINGS.—The Chicago Edison Company has issued its annual report for the year ended March 31, 1907. The income account compares as follows:

	1907.	1906.	1905.	1904.
Gross	$5,317,359	$4,744,823	$4,051,082	$3,837,699
Op. exp. and renewals	3,610,110	3,194,798	2,627,468	2,515,050
Net	$1,707,249	$1,550,025	$1,423,614	$1,322,619
Charges	365,249	363,976	360,232	307,088
Surplus	$1,342,000	$1,186,049	$1,063,382	$1,015,531
Depreciation res.	100,000	100,000	100,000	100,000
Balance	$1,242,000	$1,086,049	$963,382	$915,531
Dividends	999,846	887,556	789,262	720,526
Surplus	$242,154	$198,493	$174,129	$195,005

The surplus available for dividends after charging off $100,000 for depreciation is equal to 9.12 per cent earned on the $13,608,600 capital stock issued. The allied Commonwealth Electric Company's report for the year ended March 31, 1907, compares as follows:

	1907.	1906.	1905.	1904.
Gross	$3,524,729	$2,507,772	$1,816,765	$1,350,999
Expenses and renewals	2,588,158	1,803,214	1,228,403	834,734
Net	$936,571	$704,558	$588,362	$516,265
Charges	406,021	363,889	305,069	275,737
Surplus	$530,550	$340,669	$283,293	$240,528
Depreciation res.	$136,000	$119,000	$119,000	$102,000
Surplus	$394,550	$221,669	$164,293	$138,528

After charging off $136,000 for depreciation, the surplus shows 3.94 per cent earned on the $10,000,000 capital stock.

PACIFIC LIGHTING CORPORATION.—The reorganization of the Pacific Lighting Corporation, of Los Angeles and Eureka, has been effected by the filing of articles of incorporation with the County Clerk by which the capital of the company is increased to $20,000,000, in $10,000,000 of preferred stock and $10,000,000 common. In the new articles Alfred Sutro, C. O. G. Miller, George F. Voltman, Charles Holbrook and G. H. Collins are named as having subscribed for one $100 share each. Alfred Sutro said that the company's business had increased to such an extent that it has been thought advisable to enlarge its scope. Operations are not contemplated in San Francisco.

CONNECTICUT LIGHTING.—F. J. Lisman & Co., of New York, Hartford, Philadelphia and Chicago, offer to investors at $75 2000 shares of the Connecticut Railway & Lighting Company 4 per cent guaranteed common stock. The company is leased to the Consolidated Railway, and the lease is guaranteed by the New York, New Haven & Hartford Railroad Company, and there is a cash fund on deposit with the Colonial Trust Company sufficient to pay 4 per cent up to the year 1914, and about 4⅛ per cent thereafter. The bankers consider the stock exceedingly attractive on a 5¼ per cent basis, and reasonably sure to sell at or above par in the course of time.

CONSOLIDATION IN CONNECTICUT.—At a special meeting of the stockholders of the New York, New Haven & Hartford Railroad Company held in New Haven, May 31, the company was merged with the Consolidated Railway Company, a company capitalized at $10,000,000, which serves as a holding company for the New York, New Haven & Hartford Railroad Company's electric lines in Connecticut. Under the terms of the transaction, the Consolidated Company will continue to use the same name, but will operate under the charter of the Consolidated Railway Company.

UTICA GAS & ELECTRIC.—The Utica Gas & Electric Company of Utica, N. Y., has made application to the state gas commission for consent to issue $2,000,000 5 per cent, 50-year bonds under its $5,000,000 mortgage. The company seeks authority to acquire the Herkimer County Light & Power Company, the Glens Falls Gas & Electric Light Company, the Consolidated Light & Power Company of Whitehall and 51 per cent of the capital stock of the United Gas, Electric Light & Fuel Company.

GENERAL NEWS

Construction News.

ATTALLA, ALA.—The Etowah Light & Power Company is contemplating enlarging and increasing the capacity of its plant soon. Adolphus Brown is president and manager.

GREEN FOREST, ARK.—The City Council has granted a franchise to the Farmers' Union Telephone Company to install a telephone system in this city.

POTTER VALLEY, CAL.—The Snow Mountain Water & Power Company has applied to the Town Board of Trustees for a franchise to erect its transmission lines for the purpose of distributing electricity for lighting and power purposes in the village. Bids will be received for the above franchise until July 13 by the Board of Trustees.

ST. HELENA, CAL.—Bids will be received by the Board of Trustees until July 9 for the sale of the franchise applied for by Henry Brown, to erect and maintain transmission lines for the distribution of electricity in St. Helena. The franchise is for a term of 50 years.

SAN BERNARDINO, CAL.—The Victor lands have been transferred to the Westwater Power & Water Company, which was recently incorporated with a capital stock of $600,000 by A. E. Poole, W. G. Hopkins, A. C. Lowe, Robert Westwater and J. P. Scott. An auxiliary company, capitalized at $2,000,000, will be formed to construct the reservoir. It is proposed to tunnel the mountains and bring water to the west side, and develop electrical energy to supply communities in this valley and on the desert.

SAN DIEGO, CAL.—An application has been filed by E. Bartlett Webster for a franchise to operate a street railway system in this city.

SAN FRANCISCO, CAL.—The Board of Supervisors has determined to reconstruct the Geary Street municipal street railway and has appropriated a total of $720,000 for the purpose of changing the cable system into an underground electric system.

SUISUN, CAL.—E. D. N. Lene, of Dixon, has applied to the Board of Supervisors for a franchise to erect poles and wires for transmitting electricity for light and power purposes along certain roads from Dixon to Rio Vista, and also in Silverville, Elmira and Green Valley townships.

MANITOU, COL.—The Manitou Electric Company has been awarded the contract for lighting the streets of the town. W. A. Bell is president of the company.

SILVERTON, COL.—The City Council has entered into a contract with the Animas Power Company to furnish electricity to operate the municipal electric lighting system. By the terms of the contract the city is to pay 1½ cents per kw-hour with a guaranteed consumption of 40,000 kw per month. The contract is for five years.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Light Company is installing four three-hp motors in the factory of E. A. Mallory & Sons. The company will soon install two 20-hp motors for the operation of two new forming machines in the same factory.

MYSTIC, CONN.—The bill incorporating the Mystic Electric Light, Gas, Heat & Power Company has been passed by the State Legislature. It is expected that the new company will absorb the Westerly Power Company, and that the new line between Westerly and this borough will soon be completed, when a day service will be maintained. Electric energy for operating the system will be furnished from the Westerly power house.

NEW HAVEN, CONN.—The Macdonald Engineering Company has applied to the Legislature for a charter. The company proposes to construct and operate an electric light and power plant. The incorporators are Col. Theodore H. Macdonald, of New Haven; O. M. Custer, W. J. Sanford and B. A. Stanley.

NEWTOWN, CONN.—It is reported that the Consolidated Railway Company has purchased all the land and water rights of the Housatonic Power Company in Newtown, the Walcott place and other properties along the river.

ROCKVILLE, CONN.—The legislative committee on cities and boroughs has reported unfavorably on the resolution amending the charter of the city of Rockville so as to authorize the city to engage in the municipal lighting business.

THOMPSONVILLE, CONN.—The Northern Connecticut Light & Power Company is now engaged in making the necessary alterations for a 24-hour service, which is expected to be put in operation about the middle of this month. When the improvements are completed the power house located on Central Street will be dismantled and most of the machinery removed, and the local plant will only be used in cases of emergency, as electricity for operating the system will be furnished from the main power plant in Windsor Locks.

OCALA, FLA.—The question of installing a new engine, generator and boiler in the municipal electric light plant is now under consideration. E. C. Bennett is superintendent.

BLAKELY, GA.—Plans are being made for increasing the capacity of the municipal electric lighting plant, which includes the installation of a 200-kw, three-phase, 60-cycle, direct-connected unit, and overhauling all the lines. J. N. Green is manager.

NEWNAN, GA.—W. B. Pringle, secretary Water and Light Commission writes that contracts for equipment for the electric light station have been awarded as follows: Harrisburg Foundry & Machine Company, Harrisburg, Pa., two engines of 225 hp each; Crocker-Wheeler Company, of Ampere, N. J., two direct-connected 150-kw alternators; switchboard for above equipment to the Fort Wayne Electric Works, of Fort Wayne, Ind. Total cost of the contracts is $11,940.

TENNILLE, GA.—The citizens are contemplating increasing the capacity of the municipal electric light plant and are planning to install two 75-kw generators, a 125-hp engine and a boiler of 125 hp capacity. S. O. Franklin is treasurer and manager.

BOISE, IDAHO.—Water filings recently made in the office of the state engineer would indicate that the proposed railway to be built over the Bitter Root Range, between Montana and Idaho, by the Chicago, Milwaukee & St. Paul Railway Company will be an electric road. The filings were made by I. N. Smith, of Lewiston, attorney for the railway interests, under the name of the Idaho Water & Electric Power Company, just organized, and cover the waters of the St. Joe River, and the north fork of the stream. In the plans and specifications filed with the State Engineering Department the construction of 16 dams is provided for, which with other work will cost about $923,000. The total capacity of the plants will be about 46,000 hp.

SAND POINT, IDAHO.—A. McDonnell reports that an electric railway is to be built in Lakeview for the purpose of carrying ore from the Weber mine to the lake, a distance of about nine miles.

BELLEVILLE, ILL.—The City Council has passed an ordinance granting a franchise to the Belleville & Interurban Railway Company to construct and operate an electric railway on South Illinois Street.

FREEPORT, ILL.—Charles E. Gregory has filed with the Secretary of State articles of incorporation for his new lighting enterprise. The gas and electric branches of the business will be consolidated in one company, to be known as the Stephenson Lighting & Power Company. The company is capitalized at $5,000 and the incorporators are Edwin R. Rockwell, Edwin H. Frank and Charles E. Gregory.

FREEPORT, ILL.—It is reported that the Freeport Railway, Light & Power Company will soon erect a new power plant and otherwise improve the lighting and street car service.

HILLVIEW, ILL.—Louis Lowenstein, of Hillview, writes that all bids opened on June 4 for the construction of power house and pumping station have been rejected, and that new bids will be received for the proposed work until June 21.

LAWRENCEVILLE, ILL.—The Citizens' Telephone Company of Lawrence County has increased its capital stock from $20,000 to $40,000.

ALEXANDRIA, IND.—The municipal electric lighting plant in this city has been purchased by the Central Indiana Lighting Company. The company has purchased all outstanding bonds and paid the floating debts. The plant has been in operation several years and has been run at a loss and given unsatisfactory service.

ATTICA, IND.—Plans are being made to increase the capacity of the municipal electric plant and orders have been placed for the following equipment: The Ironton Engine Company, Ironton, Ohio, for two heavy duty engines; Fort Wayne Electric Works, Fort Wayne, Ind., two 100-kw generators, one of 150-180 volts, the other 250-280 volts. The old unit will be used for a day power service which will be put in operation about July 1, giving 120 and 220 volts for motor work and miscellaneous lighting. The capacity of the plant will be increased by about 350 horse-power. G. McDonald is manager.

BEDFORD, IND.—The Home Telephone Company has increased its capital stock from $75,000 to $250,000.

FARMERSBURG, IND.—A. D. Torr, owner of the local electric light plant, writes that he is contemplating the installation of a 300-hp engine.

GREENCASTLE, IND.—The electric light plant located on South Morton Street was badly damaged by fire recently, causing a loss of about $10,000.

HUNTINGTON, IND.—The City Council has instructed the Mayor to secure estimates on the cost of repairing the municipal electric lighting plant.

INDIANAPOLIS, IND.—The Indianapolis Star Building is thoroughly equipped with electricity. Every machine in the building, including the large presses, is operated by electricity, each machine having an individual motor, all of which were installed by the Jenney Electric Manufacturing Company of this city.

NEW ALBANY, IND.—The Louisville & Northern Railway & Light Company is having surveys made for locating an electric railway from this city to French Lick and West Baden Springs. Contracts for con-

struction of the road will be awarded as soon as the survey is completed.

SHARON CENTER, IA.—The Farmers' Mutual Telephone Company has increased its capital stock from $4,500 to $8,000.

WASHINGTON, IND.—H. C. Franklin, of Indianapolis, is in the city making an investigation of the condition of the electric light system, with a view of making estimates of the cost of remodelling and repairing the plant.

NEW MARKET, IA.—The citizens are agitating the question of lighting the town by electricity, to be furnished from the power house at Clarinda.

FREDONIA, KAN.—The Fredonia Ice Company is contemplating installing an electric plant to furnish electricity for lighting the town.

LEXINGTON, KY.—The directors of the Lexington & Interurban Railways Company have decided to construct an interurban electric railway from this city to Nicholasville.

LOUISVILLE, KY.—The lower board of the City Council has set aside about $30,000 for the purpose of installing an electric light and heating plant in the city hall annex.

BATON ROUGE, LA.—The Baton Rouge Electric & Gas Company has been reorganized under the name of the Baton Rouge Electric Company, and the capital stock of the new company is placed at $750,000. The officers of the company are: George Tripp, of Boston, Mass., president; Edward Codchaux, of New Orleans, vice-president; A. K. Todd, secretary, and A. S. Pratt, treasurer. Stone & Wenster, of Boston, Mass., are interested in the new company, which will make extensive improvements and additions to the present plant.

HOUMA, LA.—A site has been purchased on which the new municipal electric light plant will be erected. J. P. Campbell is mayor.

LIVERMORE, ME.—The Livermore Falls Electric Light & Power Company has changed the location of its power station from the Umbagog mill to the Livermore mill on the Falls side of the river. The company has recently installed a 1300-hp water wheel and a new generator of 75-kw capacity. The old plant will be held in reserve to use in case of emergency. Another wheel and generator are being installed in the Livermore mill to generate electricity to be transmitted to Chisholm to operate the Otis mill at that place.

PORTLAND, ME.—The organization of the Portland & Northern Electric Railroad, which has been chartered to build an electric railway from this city to Bridgton, has been completed and the following directors elected: Howard Winslow, Llewllyn Barton, H. L. Ford, of Portland; S. O. Hancock, Norman D. Sturgis, of Scranton, Pa., and Tracy W. Holland, of New York. The company is capitalized at $160,000. Surveys for the line will be made at once.

DEDHAM, MASS.—At a town meeting held recently the citizens voted to renew the electric lighting contract with the Edison Electric Illuminating Company.

FLORENCE, MASS.—The Norwood Engineering Company is installing a large electric motor, and will operate its entire plant by electricity.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company is extending its line to the lime kilns, which will in the future be operated entirely by electricity. A 30-hp motor will be installed.

WEBSTER, MASS.—Governor Guild has signed the bill authorizing the Webster Electric Light Company and the Southbridge Gas & Electric Company to consolidate. The consolidation must be made by January 1, 1908, or the act becomes null and void.

WRENTHAM, MASS.—At a special town meeting held June 6, the citizens voted in favor of establishing a municipal electric light plant and water works plant.

DAVISON, MICH.—S. Phelps has petitioned the Village Board for a franchise to build and operate an electric light and power plant in this village.

DETROIT, MICH.—Mayor Thompson has engaged H. H. Crowell, of Syracuse, N. Y., to make an investigation of the electric lighting conditions in Detroit.

HANCOCK, MICH.—E. T. Sykes, of Minneapolis, Minn., is preparing plans for a municipal electric lighting plant in this place.

MANCELONA, MICH.—The electric light plant was burned recently. This is the second time within two years that this plant has been burned. The loss is about $4,000; fully insured.

MENOMINEE, MICH.—Application has been made to the City Council by C. O. Johnson, general manager of the Hydro-Electric Company, of Oshkosh, Wis., for a franchise for the transmission of electricity in this city.

MILFORD, MICH.—The Village Board has entered into a contract with F. S. Hubbell, to light the streets of the village and to furnish electricity to operate the water pumps. According to the contract Mr. Hubbbell is to furnish 23 arc lamps and furnish electricity for operating the water works pumps for $3,400 per year, which is $520 more than the village paid last year.

NEGAUNEE, MICH.—H. F. Pearce, superintendent of the municipal electric light plant, writes that it is proposed to increase the capacity of the plant by installing a turbo-generator set of 500-kw capacity and extra boilers.

PONTIAC, MICH.—The Pontiac Lighting Company has purchased the plant and holdings of the Pontiac Standard Lighting Company. The change in ownership took effect June 1. The contract for street lighting held by the Standard Company has been assigned to the Pontiac Lighting Company. The company will make extensive improvements and will remodel the plant. E. C. Bechtel, of Toledo, Ohio, has been appointed consulting engineer and will have charge of the work.

VASSAR, MICH.—The citizens on May 27 voted to issue $10,000 in bonds for improving the electric light plant, and also to pay off the indebtedness on the plant.

BIWABIK, MINN.—The Biwabik Mining Company is considering a proposition to erect an electric light and water works plant for the purpose of furnishing the town with electricity and water.

BRAINARD, MINN.—The Brainard Milling Company is considering the question of constructing an electric light plant.

BRECKENRIDGE, MINN.—D. J. Jones, city clerk, is receiving bids for 1000 incandescent electric lamps.

DAWSON, MINN.—The Dawson Light, Power & Water Company will soon install an 80-kw, 125-volt generator belted to a 100-hp engine in its plant and will also extend its lines. T. W. Miller is manager.

MOTLEY, MINN.—The Motley Local Telephone Company has been formed and will take over the local exchange.

ST. PAUL, MINN.—The Board of Managers of the Minnesota State Agriculture Society is considering the question of installing an electric lighting system at the State Fair Grounds. C. N. Cosgrove is president of the society.

MERIDIAN, MISS.—The Meridian Light & Power Company proposes to amend its charter authorizing an increase in capital stock from $1,000,000 to $2,000,000. The company is contemplating extending the street railway and lighting systems.

ST. JOSEPH, MO.—A proposition has been submitted by E. W. Clark & Company, who control the St. Joseph Railway, Light, Heat & Power Company, of Philadelphia, Pa., to build an interurban railway from St. Joseph to Atchison, Kan.

UNIVERSITY PLACE, NEB.—A special election was held June 8 to vote on the proposition of issuing bonds to the amount of $15,000 to rebuild the electric lighting system. Plans for the work are in the hands of Baker & Early, Lincoln, consulting engineers.

NEWARK, N. J.—The lighting committee of the Board of Public Works on June 6 voted to enter into a new contract with the Public Service Corporation for street lighting, for a term of four years from September, 1908, at the rate of $70 per lamp per year. Under the agreement to be made, the Public Service Corporation will grant a rebate of $20 from the present rate of $95 per lamp during the time the existing contract has to run.

STANHOPE, N. J.—A company composed of local and outside capitalists organized by D. M. Cook, of Newark, has purchased the plant and holdings of Edward T. Willis in this place. The plant furnishes electricity for lighting this place and Netcong. The new company will soon file articles of incorporation.

BUFFALO, N. Y.—The ordinance requiring all electric wires to be placed underground was approved June 6 by Acting Mayor Louis P. Fuhrmann. By the terms of the contract for street lighting the General Electric Company can increase the rate from $56 per year to $75 for all lamps furnished by the conduit system, which will increase the cost of street lighting for the five years, $16,283.

CANANDAIGUA, N. Y.—The Canandaigua Southern Company has decided to extend its railway it proposes to build through the Bristol Valley from Atlanta to Wayland, a distance of six miles. An application will soon be made to the State Railroad Commissioners for permission to execute a mortgage to secure a bond issue.

ELMIRA, N. Y.—The Elmira Water, Light & Railroad Company is planning extensive improvements and additions to its system in this city, which will involve an expenditure of about $225,000. An order has been placed for an electric generator of 2623-kw capacity.

NEW YORK, N. Y.—Sealed bids or estimates will be received by the Park Board at the office of the Department of Parks, Arsenal Building, Fifth Avenue and Sixty-fourth Street, Borough of Manhattan, until June 27, 1907, for work and material for the installation of electric equipment, elevators, lifts, book conveyors and pneumatic tubes, in the New York Public Library, Astor, Lenox and Tilden Foundations, Fifth Avenue, Fortieth and Forty-second Streets. Plans may be seen and blank forms may be obtained at the office of the Department of Parks, and also at the office of the architects, Carrere & Hastings, No. 28 East Forty-first Street, Manhattan. Moses Herrman is president.

NIAGARA FALLS, N. Y.—Plans have been submitted to the City Council for the illumination of Falls Street, which will involve an expenditure of $6,000 for the first year. After the first year the sum of $1,800 will be added, the cost of the electricity for operating the lamps at the rate of $12 per horse-power per year. The Niagara Falls Hydraulic Power & Manufacturing Company has agreed to furnish electricity free for the first year on the condition that the city will purchase the electrical power at the company's plant.

ROCHESTER, N. Y.—It is stated that the Rochester Railway Company is negotiating with the Niagara, Lockport & Ontario Power Company to furnish 2000 hp to operate various electric railways controlled by the Rochester Railway Company.

TROY, N. Y.—The Troy Gas Company has announced the following rates for electricity beginning June 1: The present base rate of 15 cents per kw-hour will be reduced to 10 cents; when the consumption exceeds 1400 kw-hours a month, the rate will be nine cents per kw-hour; more than 2000 kw-hours, eight cents; more than 3000 kw-hours, seven cents, and more than 4000 kw-hours, six cents. Special rates will be made where the consumption exceeds 6000 kw-hours. Large reductions will be made in the rates for electricity used for power purposes. The company has also made a reduction in the price of gas from $1.25 per thousand cubic feet to $1.20 per thousand.

WEBSTER, N. Y.—The question of having the town lighted by electricity is now under consideration by the town and village boards. If it is decided to light the town the system will be installed by the Rochester Railway & Light Company.

WESTFIELD, N. Y.—The electric light committee has been authorized to let contracts for improvements to the electric light plant not to exceed $4,960. The equipment will consist of new arc enclosed lamps, alternator, exciter, switchboard and other apparatus. The old machinery now in use will be offered for sale to the highest bidder.

WETMORE, N. Y.—Application has been made by the village of Lowville before Justice Rogers for the appointment of commissioners in condemnation proceedings against the Wetmore Electric Company and the Beaver River Light & Power Company. The village recently voted to expend $85,000 for a lighting plant; the two companies have refused to sell and the village has taken the matter into the courts.

CANTON, N. C.—The citizens have voted to issue $65,000 in bonds for the construction of an electric light plant, water works and sewerage system.

CHARLOTTE, N. C.—A northern company, represented by Dr. J. M. Blair, of Monroe, N. C., is taking options on property at Smith's Ford, with the view of developing a water power on the Rocky River at that place. It is proposed to furnish electricity to operate manufacturing plants in Concord, N. C., also to furnish electrical power to mills in Aibermarle, Charlotte, Mt. Pleasant and other towns within a radius of 25 miles.

NEWBERN, N. C.—Bids will be received until June 20 by the City Clerk for $30,000 in bonds to be issued for improvements to the water, light and sewerage plants.

TRYON, N. C.—The Tryon Electric Light, Water & Power Company is contemplating the construction of a power plant on the Pacolet River, to cost about $65,000, for which preliminary surveys have been made. Todd Russell is general manager.

CLEVELAND, OHIO.—The Erner Electric Company of this city has increased its capital stock from $50,000 to $125,000.

GEORGETOWN, OHIO.—Sealed proposals will be received by the Board of Trustees of Public Affairs until July 13 for boiler, chimney (brick or concrete), arc and commercial pole lines, arc lamps, switchboard, transformers, etc., for the electric light plant now under construction. Plans and specifications may be had by application to W. A. Egler, clerk, Georgetown, or George Hornung, 612 Johnson Building, Cincinnati, consulting engineer.

HAMILTON, OHIO.—The Cincinnati, Reading & Middletown Traction Company has applied to the Butler County Commissioners for a franchise to construct an electric railway over the Cincinnati and Dayton and Blue Ball pikes.

HAMILTON, OHIO.—The City Council has granted a 25-year franchise to the Columbia Gas & Electric Company, of Cleveland. The company is to take over the producer and equipment of the municipal lighting plant, and has agreed to pay the interest on $115,000 of a total of $250,000 in bonds issued by the city of Hamilton as remuneration for its franchise.

MILFORD CENTER, OHIO.—It is reported that the municipal electric light and water plant is to be sold at auction.

SALINEVILLE, OHIO.—The Salineville Electric Light, Heat & Power Company is contemplating installing an 18-kw, 60-cycle, alternating-current unit to carry the after-midnight load. J. Homer Boals is chief engineer.

TOLEDO, OHIO.—H. H. Shirer, of Columbus, secretary, State Board of Charities, writes that Edward Bayer, 1630 Nicholas Building, Toledo, is preparing plans for the proposed power and heating plant for the County Infirmary.

TOLEDO, OHIO.—Bids will be received until June 24 by the County Commissioners for furnishing materials required in installing boilers, dynamos, machinery and appurtenances in the heating and power house to be erected at the Lucas County Infirmary, also the necessary conduits and piping outside the said power house. Also, same date and place, separate bids for furnishing the material and erecting a heating and power house, including stock for same, at the Lucas County Infirmary. J. W. Kerr is chairman.

WARREN, OHIO.—The Village Council has refused to purchase the light and water plant of the Warren Water & Light Company at the price asked, $400,000, as it is considered too high.

YOUNGSTOWN, OHIO.—The Grand Opera House is to be completely re-wired this summer to comply with the instructions of the Ohio Inspection Bureau. The switchboards will be overhauled and other improvements made in the system.

BAKER CITY, ORE.—The Eagle River Electric Power Company is planning to install a power plant near the Sanger mine near Baker City, which will furnish 1200 horse-power. The Virtue mine will use 500 horse-power and the Sanger mine will use the remainder.

LA GRANDE, ORE.—S. A. Thompson, of the General Electric Company, of Portland, and a number of interested parties from La Grande and Baker City have been in the upper Grand Ronde district investigating an extensive power project. It is estimated that between 8000 and 25,000 horse-power can be generated along the upper Grand Ronde River about 40 miles above La Grande. The plan contemplates two power stations, one at the foot of Carson Hill at the mouth of Tanner Gulch, and the other at Woodley. The prospective points at which the power is to be delivered are Pendleton, La Grande, the adjacent mining district and to the O. R. & N. Company. It is given out that the railroad company stands ready at any time to contract for 2000 horse-power to use in helper train service over the Blue Mountains.

MYRTLE POINT, ORE.—The Coquille Valley Light & Power Company has secured extensive water rights on the south fork of the Coquille River.

CORRY, PA.—Plans are being made to extend the line of the Corry & Columbus Street Railway to Ashville, N. Y.

HARRISBURG, PA.—The Lewisberry & Strinestown Street Railway Company is planning to extend its lines from York County to this city. David Pepper, Jr., is president of the company and J. D. Duncan is secretary, both of Philadelphia.

PHILADELPHIA, PA.—The Philadelphia & Western Railway Company has been organized as successor to the Philadelphia & Western Railroad. The officers and directors are: George R. Sheldon, president; Thomas Newhall, vice-president; Davies Murdoch, secretary and treasurer; the directors are George R. Sheldon, Randolph Rodman, James H. Brewster, Jr., Thomas Newhall, William H. Simms, W. Robinson Molinard and Joseph S. Clark. The company has decided to authorize a bond issue of $20,000,000, of which $4,000,000 is to be floated immediately, and also to issue $4,000,000 in capital stock.

PHOENIXVILLE, PA.—The Philadelphia Interurban Electric Railway Company has been granted a franchise to construct and operate an electric railway within the borough limits.

SHAMOKIN, PA.—The Shamokin & Coal Township Light & Power Company has absorbed the plants of the Shamokin Electric Light & Power Company, the Shamokin Arc Light Company, the Shamokin Gas Light Company and the Edison Electric Illuminating Company, the purchase price being $275,000. The new company will be known as the Shamokin & Coal Township Light, Heat & Power Company. The company will be capitalized at $600,000 and the directors are George C. Graeber, John Mullen, W. C. McConnell, C. C. Leader and Henry S. Zimmerman.

TOWANDA, PA.—The question of installing a municipal electric lighting plant is now being considered by the Borough Council. William Foyle is chief burgess.

SENECA, S. D.—The Town Board has granted the Seneca Exchange Telephone Company a franchise for the construction of a telephone system in this town.

WILMOT, S. D.—The Council has recently ordered a storage battery for the municipal electric lighting plant from the American Storage Battery Company, to cost $1,400.

BOLIVAR, TENN.—The proposition of extending the lines of the municipal electric light plant to the Western Hospital for the Insane, a distance of three miles, is now under consideration. Benjamin Bailey is superintendent.

LEBANON, TENN.—The city authorities have entered into a contract with the Farmers' Milling Company to furnish electricity for operating the municipal electric lighting system in this city. A contract has been placed with the General Electric Company to furnish engines, generators, pumps, etc. The new engine is to be an Atlas Corliss of 500 hp; this with the engine now in use will give the plant a capacity of 650 hp. Work of enlarging and improving the buildings will begin at once, and it is expected to have the new plant in operation by Sept. 1.

DALLAS, TEX.—The Dallas Electric Light & Power Company has increased its capital stock from $700,000 to $1,400,000.

FORT WORTH, TEX.—The Northern Texas Traction Company has been granted a franchise to extend its line about two miles.

LAREDO, TEX.—The Laredo Electric Railway Company is contemplating the purchase of a new cross compound condensing engine to be direct connected to a 300-kw generator operating at 150 r. p. m.

MART, TEX.—The Mart Telephone Company has taken out a permit for the construction of a new building in this city to cost about $10,000.

WICHITA FALLS, TEX.—A franchise has been granted by the City Council to local and Fort Worth capitalists for an electric street railway in this city.

HARDWICK, VT.—The Woodbury Granite Company has purchased the plant of the Daniell Light & Power Company of this place.

CENTRALIA, WASH.—George W. Gregory, of Seattle, is interested in the construction of an electric light plant, water works system and a street railway connecting Centralia and Chehalis.

SPOKANE, WASH.—Assistant Manager Clifford S. McCalla, in charge of electrical construction for the Washington Water Power Company, announces that the company will this fall commence the work of developing the upper falls of the Spokane River. From three to five years will be required to complete the work, at a cost of probably $1,000,000. A new power house will be erected.

TACOMA, WASH.—Contracts will soon be let for a new central power and heating plant for the Western Washington Hospital for the Insane at Fort Steilacoom, for which plans have already been accepted.

BELOIT, WIS.—It is reported that the Rockford Edison Electric Light Company has purchased the power plant of the Rockford Interurban Railway and will furnish electricity to operate the Interurban and Beloit City railway lines.

HARTFORD, WIS.—The citizens are considering the question of erecting a municipal electric lighting plant in this city to cost about $25,000.

MELROSE, WIS.—Plans have been made for installing a new lighting plant in the Methodist Church in this city.

MONROE, WIS.—The City Council and the Board of Water Commissioners are considering the question of installing an electric light plant in connection with the water works.

STRATHCONA, ALA.—The Strathcona Radial Tramway Company has applied to the City Council for a franchise to construct and operate a street railway system in this city for a term of 30 years.

CRANBROOK, B. C.—The Cranbrook Electric Light Company is arranging for the construction of a long distance telephone system through the Crow's Nest Pass to connect with the system being built by the Alberta government between Calgary and Le Pas.

WINNIPEG, MAN.—The Manitoba government has purchased a site upon which to erect a central exchange for the government system to be built here. Hon. J. H. Howden, minister of telephones, states that tenders for construction will be called for immediately.

FORT WILLIAM, ONT.—The City Council has voted $36,000 for extensions to the municipal telephone system. Address Mayor Whalen.

HAMILTON, ONT.—W. C. Hawkins and Col. J. M. Gibson, of the Cataract Power Company, of this city, have made a proposition to the City Council to build a completely new electric street railway system with extensions to cost $600,000.

PORT ARTHUR, ONT.—The Hydro-Electric Commission, of Toronto, has issued a report to the effect that if the water power is developed at Dog Lake Falls electricity can be delivered in this city for $10 per hp per year. The cost of the work, which will be undertaken by this city, is estimated at $1,000,000. Address J. Clavet, mayor.

ST. THOMAS, ONT.—The Hydro-Electric Power Company is contemplating the development of a water power at Big Bend in Wardsville, for which estimates have been made by H. G. Acres, engineer of the Hydro-Electric Power Commission.

STREETSVILLE, ONT.—The town has decided to install an electric lighting plant at a cost of $20,000.

TORONTO, ONT.—The Board of Control has instructed C. H. Rust, city engineer, to make estimates of the cost of a distribution plant for electricity in connection with the city taking 15,000 hp from the Hydro-Electric Power Commission, and also to report on the best location for such a plant.

UXBRIDGE, ONT.—The Uxbridge & Scott Independent Telephone Company is making plans to build systems in Markham, Stoufville, Mount Albert, Sonderland, Claremont and other adjacent villages and to connect them with long distance lines.

WALKERTON, ONT.—The Walkerton Electric Light & Power Company is contemplating extensive improvements to its plant in this place.

MONTREAL, QUE.—John Kennedy and Ernest Marceau have presented a report for a new hydro-electric system for Montreal and it is expected that tenders for construction will be called for during June. The plans provide for the generating of 5000 electrical horse-power at the most unfavorable seasons of the year.

MONTREAL, CAN.—The first list published of the shareholders of the Montreal Light, Heat & Power Company shows that Senator L. J. Forget, one of the directors of the company, is the largest individual holder, having in his own name 4375 shares; Senator Robert Mackay, another director has 2500 shares; H. S. Holt, the president of the company, 1932 shares; Rudolph Forget, a member of the directorate, 1400 shares; James Ross, 1010 shares. There are now 4682 shares recorded on the London and Paris register.

RIMOUSKI, QUE.—The Kamouraska Telephone Company has been granted permission to increase its capital by $250,000 for the purpose of building rural extensions in Matana and Rimouski counties.

BATOPILAS, MEX.—The Mexican Government has granted the application of the Batopilas Mining Company, of Batopilas, State of Chihuahua, for a concession to install a hydro-electric plant at Los Algodones, on the Batopilas River. A transmission line will be built from the plant to the mines and smelter of the company at Batopilas.

GUADALAJARA, MEX.—It is announced that the Compania de Tranvias, Luz y Fuerza, of Guadalajara, will build a transmission line from Guadalajara to Aguascalientes, a distance of about 125 miles. It will dispose of about 5000 horse-power in that city. The company has a capital stock of $11,000,000. Andres Bermejillo, of Mexico City, has been elected president of the company.

PUEBLA, MEX.—The Compania Hidro-Electrica San Agustin, which was recently organized at Puebla, Mex., with a capital stock of $1,000,000, will install a hydro-electric plant and furnish the city of Puebla with electricity for lamps and motors. Fernando Pimentel y Fagoaga is president of the company.

Company Elections.

CHICAGO, ILL.—At the annual meeting of the Commonwealth Electric Company held recently the following directors were elected: Edward L. Brewster, Samuel Insull, Robert T. Lincoln, John J. Mitchell and Erskine M. Phelps.

ST. CHARLES, MO.—At the annual meeting of the St. Charles Lighting Company held recently, the following directors were elected: Edward Gut, H. G. C. Dammer and H. D. Mitchell, of St. Charles; T. C. Elston, of Waterloo, Ill.; Edward Clifford, of Chicago, Ill., and William Collier, of St. Louis. The board organized by re-electing Edward Gut, president; I. O. Elston, vice-president and treasurer; Edward Clifford, secretary, and H. D. Mitchell, manager.

ALLENTOWN, PA.—At the directors meeting of the Allentown Electric Light & Power Company held recently, Col. Harry C. Trexler resigned as president, and E. M. Young as vice-president. Their places were filled by David Young, of Newark, N. J., and Warren S. Hall. The latter are president and vice-president of the Lehigh Valley Transit Company, which controls by stock ownership the Allentown Electric Light & Power Company.

New Industrial Companies.

THE ELECTRIC WATER HEATER COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $200,000 by Delia B. Rawson, J. P. Stockdale, V. S. Rowley, Taylor McDougall and W. F. Haas. The company will manufacture an electric heating attachment for connection to a water faucet, which heats the water to the boiling point inside of a few minutes. Delia B. Rawson is the promotor and general manager of the company; V. S. Rowley, assistant manager and E. H. Potter, superintendent of construction.

THE TOLEDO ELECTRIC SIGN COMPANY, of Toledo, Ohio, with a capital stock of $5,000, has been incorporated by Henry E. Burkhart, Edwin J. Marshall, Wm. R. Hodge, Conrad Weil and William H. McClellan, Jr. The company will manufacture electric signs.

New Incorporations.

LOS ANGELES, CAL.—The Marine Power & Electric Company has been incorporated with a capital of $1,500,000 by G. H. Bancroft, E. C. Phipps, S. M. Wilson, W. J. Compton and R. M. Amour, of Los Angeles.

LOS ANGELES, CAL.—The Wonder Electric Power Company has been incorporated to develop power on two streams located in what is known as the Silver or Stillwater Mountains, 12 miles north of Wonder townsite.

SAN FRANCISCO, CAL.—The Direct Line Telephone Company has filed articles of incorporation with a capital stock of $1,000,000. The directors are Joseph A. Stulz, C. F. Runyon, Julius Fay and others.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Direct Line General Telephone Company. The company is capitalized at $2,500,000 and the directors are Julius Finck, A. K. Andriano, William T. Hess, Julius Fay and Charles E. Wiggin.

COLORADO SPRINGS, COL.—The Idaho-Nevada Power Company has been incorporated with a capital stock of $7,500,000 by Orlando B. Wilcox, Horace G. Lunt and John F. Adams, all of Colorado Springs. The company proposes to furnish electricity for lamps and motors to the mining companies in Idaho and Nevada, and to construct electric railways and furnish electricity for lighting towns and cities along its lines.

ALEDO, ILL.—The People's Telephone Company, of Mercer County, has been incorporated, with a capital stock of $3,500, by Peter F. Mauck and others.

CHICAGO, ILL.—The Oklahoma Fuel, Light & Power Company has been incorporated with a capital stock of $500,000 by James S. Cummins, F. H. Lanem, R. J. Graf, of Chicago, Ill., and Harry W. Davis.

GEORGETOWN, ILL.—The Citizens' Telephone Company has been chartered with a capital stock of $25,000 by Albert Sanders, Jerome Pribble and Jesse H. Lamay.

INDUSTRY, ILL.—The Industry Telephone Company has been incorporated, with a capital stock of $6,000, by R. F. Butterfield and others.

LANARK, ILL.—The Lanark Mutual Telephone Company has been incorporated, with a capital stock of $12,000, by George W. Michael, Daniel H. Stitzel and John R. Wolf.

LOW MOOR, IA.—The Low Moor Telephone Company has been incorporated with a capital stock of $5,000.

MASON CITY, ILL.—The Mason City Independent Telephone & Telegraph Company has been chartered, with a capital stock of $5,000. Dr. C. A. Stone is president.

MOUNT PULASKI, ILL.—Articles of incorporation have been filed for the Mount Pulaski Independent Telephone Company by Herman Rentmeister, S. C. Dawson and William Bauman. The company is capitalized at $5,000.

PERSIA, ILL.—The Persia Mutual Telephone Company has been chartered with a capital stock of $10,000 by E. V. Campbell and others.

SPRINGFIELD, ILL.—The Springfield, Beardstown & Quincy Railroad has been granted a charter by the Secretary of State. The capital stock is $25,000.

FOREST, IND.—The Forest Telephone Company has filed articles of incorporation, with a capital stock of $4,950.

GREENFIELD, IND.—The Greenfield Light & Power Company has been incorporated for the purpose of building an electric light plant. The cost of the plant is estimated at $25,000 and the officers of the company are R. S., president, and F. E. Barrett, secretary.

INDIANAPOLIS, IND.—The Greyford & San Jacinto Telephone Company has been chartered, with a capital stock of $300. The directors are A. E. Grimes, D. H. Ziegler and Joseph Rogers.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company is increasing the capacity of its power plant at Spring Lake by the installation of a 480-hp boiler and an 1875-kw steam turbine.

RUSSELLVILLE, IND.—The Russellville Co-operative Telephone Company has been incorporated, with a capital stock of $5,000, by Albert Lindle and others.

SHELBYVILLE, IND.—The London Telephone Company has been organized, with a capital stock of $5,000. Harry Harrell is president.

UNION MILLS, IND.—The Northern Indiana Telephone Company has been incorporated with a capital stock of $10,000.

ZENAS, IND.—The Zenas Independent Telephone Company has filed articles of incorporation with the Secretary of State. The directors are: James F. Price, John J. Hutton and Lafayette Speer.

CALAMUS, IA.—The Farmers' & Business Men's Mutual Telephone Company has been formed, with a capital of $9,996.

CURLEW, IA.—The Laurens-Curlew Telephone Company has been chartered, with a capital stock of $5,000, by F. L. Adams and others.

IOWA CITY, IA.—Articles of incorporation have been filed for the Scott Township Telephone Company with a capital stock of $2,500. The incorporators are A. E. Barnes and others.

KNOXVILLE, IA.—Articles of incorporation have been filed by the Dallas Mutual Telephone Company, with a capital stock of $1,000. The incorporators are J. A. Miller and others.

LANYON, IA.—The Lanyon Mutual Telephone Company has been incorporated with a capital stock of $5,000 by G. T. Peterson and others.

LONE TREE, IA.—The East Fremont Telephone Company has been incorporated, with a capital stock of $5,000, by J. W. Varey and others.

M'CALLSBURG, IA.—The Short Line Telephone Company has been incorporated, with a capital stock of $5,000.

SHELDAHL, IA.—The Sheldahl Telephone Company has been incorporated with a capital stock of $6,000.

WESLEY, IA.—Articles of incorporation have been filed for the Wesley Rural Telephone Company, with a capital stock of $2,000, by O. K. Florn and others.

BRANDON, LA.—The Brandon & Daniel Telephone Company has been incorporated with a capital stock of $10,000 by V. H. Russell and others.

EFFINGTON, MINN.—The Effington Telephone Company has been incorporated, with a capital stock of $5,000.

THIEF RIVER FALLS, MINN.—The Thief River Falls Telephone Company has been formed and will apply to the City Council for a franchise.

UNION HILL, MINN.—The Union Hill Telephone Company has been incorporated, with a capital stock of $8,000, by C. A. Backman, of Waterville; Joseph Widmer and E. M. Widmer, of New Prague, Minn.

COLUMBUS, MISS.—The Columbus Light & Railway Company has been incorporated with a capital stock of $300,000 to build and operate an electric light and power plant in the city of Columbus. The incorporators are Charles F. Sherrod and others.

TOPISAW, MISS.—The Topisaw Telephone Company has been incorporated with a capital stock of $2,000 by E. L. Summers and others.

BUTLER, MO.—The Mount Pleasant Telephone Company has been incorporated, with a capital stock of $2,400, by T. N. Ervin, E. D. Wilcox, Fred Church, M. C. Wilcox and others.

GEORGETOWN, MO.—Articles of incorporation have been filed for the Citizens' Telephone Company with a capital stock of $2,500 by Albert Sanders, Jerome Pribble and Jesse H. Lamey.

UNION, MO.—The Commercial Telephone Company has been incorporated, with a capital stock of $8,000, by A. J. Gorg, E. Reinhard, A. F. Mauthe and others.

ITHACA, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Ithaca-Owego Traction Company to construct an electric railway from Ithaca to Owego, a distance of 40 miles. The company is capitalized at $400,000 and the directors are George R. Peck, Brockton; H. S. Finch, Richfield, and S. E. Banks, Ithaca.

GOWANDA, N. Y.—The Gowanda Bell Telephone & Telegraph Company has filed articles of incorporation with the Secretary of State with a capital stock of $35,000. The directors are J. D. Hardy, Boston, Mass; C. S. Phelps and B. J. Crawford, of Gowanda.

KATONAH, N. Y.—The Katonah Lighting Company has been incorporated with a capital stock of $30,000, and the following directors: W. H. Fowler, J. E. Fowler and Philip Lewis, of Katonah.

LOCKPORT, N. Y.—The Lockport Light & Heat Company has been incorporated with a capital stock of $600,000 to take over the properties of the Lockport Gas & Electric Company and the Economy Light, Fuel & Power Company. The directors of the company are A. S. Cooke, M. J. Dodge and James Abbott, all of New York City.

WEST LEYDEN, N. Y.—The North Ava Telephone Company has been organized to build a telephone line between this place and Ava. Fred P. Grubel was elected president, and Frank E. Wolfe, secretary and treasurer.

ASHEVILLE, N. C.—A charter has been granted to the Swananoa Valley Railway Company to construct an electric railway from Asheville to Montreat and intervening places. The company is capitalized at $300,000 and the incorporators are H. L. Barber, E. S. Caldwell, P. R. Moale, W. R. Whitson, J. M. Chiles and G. H. Holmes.

FUGATE'S HILL, N. C.—The Russell-Mendota Telephone Company has been chartered, with J. C. Pruner, of Mendota, president. The capital stock is fixed at $1,000 to $1,500.

BOTTINEAU, N. D.—The Loop Mutual Telephone Company has been chartered with a capital stock of $8,000 by Walter Minshull and others.

PEKIN, N. D.—The Cheyenne Telephone Company has been incorporated with a capital stock of $50,000 by F. W. McDougall and others.

TIOGA, N. D.—Articles of incorporation have been filed for the Tioga Telephone Company, with a capital stock of $8,000, by A. Stakston and others.

SHERWOOD, N. D.—The Farmers' Pioneer Telephone Company has been incorporated, with a capital stock of $25,000, by E. M. Olsen and others.

BELMORE, OHIO.—Articles of incorporation have been filed for the Belmore Mutual Telephone Company with a capital stock of $2,500. The incorporators are E. G. Bach, William Glaser and others.

CANTON, OHIO.—The Akron, Canton & Youngstown Railway Company has been incorporated with a capital stock of $200,000 by G. W. Davis, Isaac H. Taylor, William Simpson, H. B. Stewart and M. L. Shackle.

CINCINNATI, OHIO.—The Ohio Electric Railway Company has been incorporated with a nominal capital of $100,000. It is said that the company has been organized for the purpose of taking over the traction companies controlled by the Schoepf-McGowan syndicate, comprising about 1200 miles of track in Indiana and Ohio, and will eventually be capitalized at from $50,000,000 to $75,000,000. The United Gas & Improvement Company, of Philadelphia, Pa., is said to be interested in the syndicate. Included in the merger are reported to be the Lima & Toledo Traction Company, which is constructing a line from Lima to Toledo, of which 18 miles is completed, and which also leases the Lima Electric Railway & Light Company, operating 12 miles; the Fort Wayne, Van Wert & Lima Traction Company; the Indiana, Columbus & Eastern Traction Company; the Cincinnati Northern Traction Company, and other lines in central and northern Ohio.

DELTA, OHIO.—The Cass County Telephone Company has increased its capital stock from $9,750 to $150,000.

HIGGINSPORT, OHIO.—Articles of incorporation have been issued to the Higginsport Independent Telephone Company, which will have a capital stock of $10,000. Charles B. Williams is one of the incorporators.

HOWELL, OHIO.—The Rankins Creek Telephone Company has been incorporated, with a capital stock of $1,000, by Newton Kite and others.

NAPOLEON, OHIO.—The Henry County Mutual Telephone Company has been incorporated by W. J. Pierrepont, Henry F. Robes, David Harmon and others.

TOLEDO, OHIO.—The Lake Erie, Fremont & Southern Railway Company has been chartered with a capital stock of $10,000 by H. F. Shunk, A. E. Clauser, Theodore Schmitt, George Luckey and others.

BITTER CREEK, OKLA.—The Bitter Creek Mutual Telephone Company has been incorporated with a capital stock of $10,000 by P. J. Herns and others.

GUTHRIE, OKLA.—The Guthrie, Camp Russell & Northeastern Rural Telephone Company has been incorporated with a capital stock of $1,300 by Shelton Morris and others.

ROSEBURG, ORE.—The Douglas & Coos Bay Electric Railroad Company has been organized and temporary officers elected as follows: L. J. Simpson, president; A. E. Marsters, first vice-president; Henry Sengstaken, secretary; J. H. Flanagan, treasurer.

EAST BRADY, PA.—The Central Allegheny Valley Telephone Company has been incorporated with a capital stock of $8,000 by R. A. Thomas and others.

HUMBOLDT, TENN.—The Missouri, Tennessee & Georgia Railway Company has been formed to build an electric railway in Crockett County. The officers of the company are as follows: Col. I. H. Duggan,

president; C. H. Ferrell, first vice-president; Dr. J. H. Thomas, second vice-president; G. D. Ferrell, secretary and O. C. Sharp, treasurer.

HOUSTON, TEX.—The Central Texas Telephone Company has been incorporated with a capital stock of $50,000 by A. B. Foster, W. E. Richards and H. B. Houston.

MERKEL, TEX.—The Merkel Light & Power Company has been incorporated with a capital stock of $100,000 by John C. Hamm and others.

WORTHAM, TEX.—The Wortham Gin & Light Company has been incorporated with a capital stock of $10,000 by W. T. Pittman and others.

TAYLORVILLE, TEX.—A charter has been issued to the Taylorville Utility Company by the Secretary of State to construct and operate a light, heating, cold storage and power plant. The company is capitalized at $5,000 and the incorporators are Albert Morgan and others.

LEBANON, VA.—The Lebanon Telephone Company has been incorporated with a capital stock of $3,000 by R. S. Meade, E. S. Finney, C. C. Anderson, V. B. Gilmer, L. L. Bays and O. S. Burns.

OAK GROVE, VA.—The Rappahannock Telephone Company has been incorporated with a capital stock of $5,000. The officers are D. H. Griffith, president; H. W. Coates, vice-president; R. B. Spilman secretary, all of Oak Grove.

SPOKANE, WASH.—The Panhandle Electric Railway Company has been chartered with a capital stock of $1,000,000 by Thomas W. Bayne, of Michigan; Amasa J. Smith, Harry M. Wallace, of Spokane, and John R. Jones, of Hillyard.

ELKINS, W. VA.—The Elkins Electric Railway Company has recently been organized for the purpose of constructing an electric railway to connect Belington and Elkins. The officers of the company are: J. C. McShadden, Rockwood, Pa., president; J. E. Morgan, of Elkins, vice-president and general manager; W. K. Taylor, of Pittsburg, Pa., secretary and treasurer.

BEAVER DAM, WIS.—The Wisconsin Midland Railway Company has been incorporated by DeWitt C. West, of this place, and others, for the purpose of constructing an electric railway from Chester to Waupan.

CARTER, WIS.—Articles of incorporation have been filed for the Carter-Wabeno Telephone Company, with a capital stock of $4,000, by Norman W. Johnson, A. J. Johnson, E. Hemenway and W. S. Slater.

COLBY, WIS.—The Colby & Southwestern Telephone Company has been incorporated, with a capital stock of $600, by Louis F. Frome, Henry A. Frome and A. K. Andrews.

HAMBURG, WIS.—The Hamburg Telephone Company has been incorporated, with a capital stock of $3,000, by M. B. Rosenberry, C. B. Bird and A. L. Kreutzer.

JEFFERSON, WIS.—The Jefferson Mutual Telephone Company has filed articles of incorporation, with a capital stock of $10,000. John M. Bienfang and others are interested.

LANNON, WIS.—The Menominee Falls Telephone Company has been organized for the purpose of installing a local telephone system.

NORTHFIELD, WIS.—The Northfield Farmers' Telephone Company has been incorporated, with a capital stock of $700, by B. F. Lanning, Antoine Ellington and John Dettinger.

QUARRY, WIS.—The Quarry Riverside Telephone Company has been incorporated, with a capital stock of $2,000, by Ole Lotten, A. H. Aifrom, K. H. Thompson and others.

SCHLIESINGERVILLE, WIS.—The Washington County Telephone Company has been incorporated, with a capital stock of $1,500, by John F. Kramer, Charles D. Storck and M. Maxam.

YUBA, WIS.—The Pine River Telephone Company has been incorporated with a capital stock of $1,500 by M. B. Lewis, John Fonta, B. K. Borland and others.

ST. MARY'S, ONT.—The St. Mary's-Medina Telephone Company, Ltd., has been incorporated, with a capital stock of $40,000.

DANVILLE, QUE.—The Danville Heat, Light & Power Company has been incorporated, with a capital of $80,000. The incorporators are: J. E. Herbert, H. Girard, G. McCracken.

SASKATOON, SASK.—The City Council has under consideration the extension of the electric lighting system.

Legal.

TRANSMISSION OF TELEGRAMS.—The judgment obtained in New York by Halstead & Company about a year ago for $2,498 against the Postal Telegraph Cable Company for an error in the transmission of a message was reversed last week by the Appellate Division, the court holding that the person receiving a telegram is bound by the same terms and conditions as the person sending the message. The court, in its opinion, said: "It is not disputed that the message here involved was an unrepeated message, and the learned court charged the jury that as between the sender and the company this was a valid and lawful limitation by contract, but he charged that it did not limit the rights of the plaintiffs, evidently upon the theory that the action being one sounding in tort, the defendants were liable to the plaintiffs for the actual damages sustained, and it is this broad question, going to the substance of the action, which we believe constitutes the fatal error in this case." The court accordingly reversed the judgment and approved a decision of the Supreme Court of Massachusetts in a similar case.

Personal.

MR. J. B. McINTOSH has been appointed superintendent of light, heat and power of the Washington, D. C., Terminal Company, his new duties dating from May 10.

MR. W. S. AUSTIN has been appointed mechanical engineer for Westinghouse, Church, Kerr & Co., of New York City. He is a member of the American Society of Mechanical Engineers.

MR. O. B. HUMPHREY, consulting engineer, has removed his office at Bangor, Maine, to the Sterns Building, 202 Exchange Street. Mr. Humphrey is a member of the American Society of Mechanical Engineers and an associate member of the American Institute of Electrical Engineers.

DR. OTTO FEUERLEIN, who is at the head of the incandescent lamp manufacturing of the Siemens & Halske interests in Berlin, and who has sometimes been dubbed the "father of the tantalum lamp," is visiting this country. While in New York the doctor is a guest at the Engineers' Club. He expects also to visit other cities before returning to Germany in July.

MR. JOHN N. SHANNAHAN, general superintendent of the electrical division of the Fonda, Johnstown & Gloversville Railroad Company, of Johnstown, N. Y., has tendered his resignation, to take effect July 1. Mr. Shannahan leaves Gloversville to become general manager of the Washington, Baltimore & Annapolis Electric Railroad. William H. Collins, master mechanic, has been elected to succeed him.

MR. FRANK E. MILLER, superintendent of power development of the Edison Electric Company, Los Angeles, Cal., has resigned his position to take effect as soon as all the construction work in connection with the company's new Kern River power plant is completed. Mr. Miller will leave the electrical field and engage in the lumber and cement business in Los Angeles.

DR. W. M. HABIRSHAW, of Habirshaw wire and cable fame, is having a warm reception from old friends in England and on the Continent, where he is now making a long trip for rest and recuperation. He is so well known everywhere he is finding it hard to limit the hospitality and entertainment extended, but has had to submit to lunches and dinners from representative Anglo-Americans like Messrs. Parshall, Blackwell, Carlton, Gilmore and E. H. Johnson, friends of long standing. Despite it all, his health is greatly improved.

MR. J. E. MOORE has been recently added to the engineering staff of the Arnold Company, Chicago. Mr. Moore is a graduate of Purdue University, and subsequently entered the employ of the Sprague Electrical Equipment Company, where he was engaged in electric railway installation and operation. Later he entered Princeton University and took an advanced course in electrical engineering, receiving in 1899 the honorary degree of Doctor of Science. At that time he took up the design and building of electric light and power plants, and about two years later became electrical engineer for the city of Davenport, Ia. Mr. Moore held this position for five years, leaving it for his present position with the Arnold Company.

MR. H. W. HILLMAN, who has been doing such energetic pioneer work in the electric heating field for the General Electric Company, is leaving Schenectady to become an operating man and will hereafter be connected with the progressive system at Grand Rapids, Mich., where notable work is being done. The Grand Rapids-Muskegon Power Company owns and controls the Grand Rapids Edison Company, which does the entire electric lighting and power business of the city, and is now delivering electricity in Grand Rapids, Muskegon, and Big Rapids, from its water power station, over high tension transmission lines located on private right of way. It controls practically all available water rights on the Muskegon River within sixty miles of Grand Rapids, which will permit of an ultimate development of 50,000 horse-power. The flow of the Muskegon River, owing to the nature of the soil and the character of the country through which it runs, is remarkably constant, and it is not subject to either damaging floods or long periods of low water. The water power plants of the company are modern and of the most permanent character of construction. The territory served is an important and growing manufacturing section. Grand Rapids, with a population of 100,000, is noted as the largest centre in the country for the manufacture and sale of furniture. Muskegon is a substantial and growing city of 25,000 people, and Big Rapids has 5000 inhabitants. In addition there are a number of smaller cities in the intervening territory. A line voltage of 60,000 to 66,000 volts is being employed for the transmission.

Trade Publications.

COAL CONVEYORS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued an illustrated catalogue showing coal and ash-handling machinery in use in numerous power houses.

VERTICAL ENGINES.—Bulletin No. 125 of the B. F. Sturtevant Company, Hyde Park, Mass., gives much interesting information concerning the design details of Sturtevant vertical engines, rated at from 6 horse-power to 85.5 horse-power. These engines are especially well adapted for direct connection to electric generators.

VENTILATING FANS.—Bulletin No. 146, of the B. F. Sturtevant Company, Hyde Park, Mass., is devoted to direct-connected electric propeller fans. The motors are completely enclosed to exclude dust. Galvanized steel plating is used for the blades, and the design is such that no reverse air currents are produced.

TUBE CLEANERS.—Bulletin No. 25, of the Liberty Manufacturing Company, Pittsburg, Pa., describes its pneumatic tube cleaner, an appliance which is claimed to have extreme power and most effective in dealing with heavy scale. As its name indicates, it is operated by air pressure and is for use where the water supply is limited. Bulletin No. 26, of the same company, describes the "Liberty" heavy duty tube cleaner, which is of all-steel construction and stated to be of unlimited power and capacity, removing scale of any thickness in a rapid manner. It requires but one man to operate and is guaranteed not to injure the tubes.

ON DRYING BRICK AND TILE.—This 16-page pamphlet, published by the Green Fuel Economizer Company, of Matteawan, N. Y., discusses artificial drying in general, and then takes up all the different ways in which brick and tile and other ceramic products can be dried by the use of heat from live or exhaust steam or from the kilns that are cooling off. It is shown that a suitable system will so increase the yearly output of a brick plant that the greater capacity will more than offset the first cost of the drying apparatus. It is also shown that by reducing the labor of handling, lessening the waste and giving a better product, a waste heat dryer will generally return its cost during the first year.

J. L. MOTT IRON WORKS, Fifth Avenue and Seventeenth Street, New York City, have just issued from the Bartlett-Orr Press a very handsome 16-page illustrated pamphlet giving a brief, comprehensive survey of their productions. To those who know the concern only as large manufacturers of baths and equippers of bathrooms the brochure is a revelation, for it includes such varied work, in addition, as electric light poles and standards, large and small fountains for the house and garden, wrought iron and bronze vases, gateways and railings, kitchen ranges, heating systems, stable fixtures, etc. Since 1828 this great establishment has been laying the foundations of a gigantic industry which, both in its utilitarian and its artistic aspects, is a credit to the founders and to the American technical arts. It may be noted that all the sanitary, bath work, etc., in the beautiful new Engineers' Club was done by the Mott Works.

Business Notes.

GOULD STORAGE BATTERY COMPANY announces the removal of its New York City offices to 341-347 Fifth Avenue.

MR. A. D. COLEMAN and Mr. A. L. Mee, of Albuquerque, New Mex., who were formerly officers of the Southwestern Electric & Construction Company, have bought the Kinsley Electric Light & Power Company, of Kinsley, Kan.

COOPER HEWITT LAMPS.—The Cooper Hewitt Electric Company, of New York City, has opened an office at 66 State Street, Albany, N. Y. The manager is Mr. S. H. Knapp, who will handle the sale of these mercury vapor lamps, etc., in the northern and eastern parts of New York State.

DIXON CRUCIBLE MEETING.—At a special meeting of the directors of the Joseph Dixon Crucible Company, held May 31, to take action on the death of vice-president and treasurer, John A. Walker, Geo. T. Smith was elected vice-president, Geo. E. Long, treasurer, and Harry Dailey was elected director and secretary.

JEWELL ELECTRICAL INSTRUMENT COMPANY.—Mr. Oscar P. Wodack, formerly of the Standard Appliance Company, and the American Electrical Supply Company, Chicago, and for a long time associated with Mr. McGill and the Crescent Electric & Manufacturing Company, Valparaiso, Ind., has taken an active interest in the Jewell Electrical Instrument Company and been elected secretary, and with full charge of the sales department.

POWER IMPROVEMENT COMPANY.—Mr. George B. Foster, formerly in charge of the Wagner-Bullock sales agency in Chicago, and recently the assistant sales manager of the Allis-Chalmers Company, is now connected with the Power Improvement Company of Milwaukee, at its Chicago office in Fisher Building. The Power Improvement Company in its capacity of commercial and industrial engineers, is prepared to take contracts of every magnitude. It also makes a specialty of industrial and water-works installation.

THE WALKER ELECTRIC COMPANY, switchboard builders, of Philadelphia, has just taken title to a piece of property, in that city, a part of which it has been occupying for several years past. It is the intention to tear down the present buildings and erect new and modern structures especially designed to meet the requirements of the business, as soon as press of work now in hand permits. The location is an improving one, within fifteen minutes' walk from the heart of the city, and almost adjoining the new Parkway now under construction. The tract includes houses now occupied as dwellings and has a frontage on Noble Street between Twenty-Third and Twenty-Fourth of 140 feet extending through to Callowhill Street, a distance of 227 feet. This should afford ample room for its rapidly expanding business. Mr. W. H. Tapley, general manager of the Walker Electric Company, formerly chief electrician of the Government Printing Office at Washington, under whose direction the new Public Printing Office was erected and equipped, is drawing the specifications for a modern power plant. Electric drive will be employed wherever conditions admit.

THE CARSTARPHEN ELECTRIC COMPANY, Denver, Col., has moved its entire establishment to larger and more commodious quarters at Colfax and Broadway. The steadily increasing demand recently for panel boxes, cabinets, switchboards and other products which this firm manufactures, together with a general growth in all departments has made this step necessary. This company has a wide reputation throughout the West as manufacturer of large switchboards and as having constructed some of the largest and most elaborate X-ray coils in the country. It undertakes the construction of any kind of electrical, experimental or scientific apparatus generally supposed to be produced only in the extreme East, as illustrated in its pioneer work in wireless telegraphy, some of the apparatus made by it having been in daily operation for the past six years on the Pacific Coast. In the new location provision has been made for an electric garage and charging station, in connection with the agency for an electric machine and of a storage battery. W. P. Carstarphen, Jr., is president and manager and D. M. Gray, secretary and treasurer of the firm. L. M. McBride is retained in the capacity of assistant manager and engineer.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 4, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

855,440. ELECTRICAL SAFETY DEVICE; Richard Apt, Berlin, Germany. App. filed Aug. 17, 1906. A lightning arrester including a spark gap constituting a discharge path for abnormal charges and which is provided with radio-active material so as to decrease the break down potential thereof.

855,450. POTENTIAL-REGULATOR; James H. Duncan, St. Louis, Mo. App. filed Mar. 22, 1906. A regulating device for generators operating a lamp circuit and having storage batteries which are automatically connected and disconnected into the circuit to keep the potential thereof uniform.

855,458. MICROPHONE; Newman H. Holland, Chicago, Ill. App. filed July 28, 1906. A microphone comprising an electrode arranged to be vibrated by sound waves, a balanced electrode pivotally mounted at its center of gravity and having a part adjacent to the first electrode, a spring normally urging the pivoted electrode toward the other, and granules of conducting material interposed between said electrodes and arranged to normally urge said electrodes apart.

855,470. MOTOR CONTROLLING DEVICE; Carl Mittelstrass, Hermsdorf, and Albrecht Frank, Berlin, Germany. App. filed Oct. 17, 1906. A device for controlling electric motor circuits. Provides a device of this character which upon the occurrence of abnormal conditions in the circuit, will automatically return to position to protect the motor. Relates more specifically to starting or controlling devices for electric motors in which an auxiliary motor is utilized for the movement of the controlling arm.

855,471. INSULATING STUD AND METHOD OF MAKING THE SAME; Edgar W. Mix, Paris, France. App. filed Aug. 1, 1906. A construction of stud for miscellaneous purposes having two parts insulated from one another. One part has a socket and the other part has a portion forming a shouldered boss entering said socket and wrapped with mica.

855,484. CONSTANT CURRENT GENERATOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed August 7, 1905. In a constant-current generator, a field winding, and an armature winding provided with commutator and brushes, said brushes being arranged on a line at an angle of less than forty-five electrical degrees to the line of magnetization of the field winding and connected to the load-circuit, said generator being arranged to be saturated at normal load.

855,485. CONSTANT-CURRENT GENERATOR; Charles P. Steinmetz, Schenectady, N. Y. App. filed August 7, 1905. In a constant-current generator, a plurality of armature windings of the open coil type, a plurality of sets of series transformers, each of the armature windings being connected in closed circuit through the primaries of one transformer of each set, and a plurality of rectifying commutators connected respectively to the secondaries of the several sets of transformers.

855,492. CONDUIT FOR ELECTRIC RAILWAYS; John S. Alexander, New York, N. Y. App. filed Mar. 14, 1904. Conduit construction for street railways in which the track rails and the conduit rails are supported on horizontal flat ties and stiffened by inclined tie rods between the conduit and the track rails.

855,494. ELECTRICAL SWITCH; James P. Appleby, Hopkins, Minn. App. filed Apr. 3, 1905. An improved lock attachment for the switch of electric igniting apparatus for automobiles, etc., so that they cannot be started without insertion of a suitable key.

855,513. RECIPROCATING ELECTRIC MOTOR; Ronald P. Irving, Quincy, Mass. App. filed Nov. 21, 1906. An electric power hammer having a sectionally wound solenoid in place of the usual steam piston and a carbon resistance device for controlling the energization thereof.

855,531. GAS LIGHTER ATTACHMENT; William Roche, Jersey City, N. J. App. filed Sept. 21, 1906. Improvement in gas lighters of that class which are adapted for use in connection with dry batteries. A curved extension is adapted to be directly attached to the carbon element of the battery and has a platinum heating coil at its extremity.

855,536. ELECTRIC COOKING STOVE; David C. Smith, Kalgoorlie, Western Australia, Australia. App. filed Aug. 11, 1906. A rectangular sheet metal casing has double walls with an asbestos filling and heating coils therein. The top of the receptacle has hinged covers.

855,545. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Dec. 16, 1904. Relates to details of cord circuit for multiple exchange system.

855,546. TELEPHONE EXCHANGE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Dec. 16, 1904. Modifications of the above.

855,550. ELECTRIC SWITCH BOX; William R. Atkinson, New York, N. Y. App. filed July 16, 1906. A construction of a metallic box with open sides which may be covered by sliding panels. Has lugs by which the top may be bolted in place.

855,601. ELECTRIC RAILWAY SWITCH; Edward F. Winfield, Los Angeles, Cal. App. filed July 7, 1903. A track switch for trolley roads having circuits moving the switch point to a predetermined position whenever the car approaches the same. If the car takes more than a predetermined current thereafter the switch point is thrown to the opposite side.

855,623. MOTOR CONTROL; Henry B. Emerson, Schenectady, N. Y. App. filed Oct. 17, 1906. Relates to the control of motor driven devices such as printing presses which must be operated at widely varying speeds. Complete diagram of circuits for controller of motor having two motors with differential gear connections.

855,711. AUTOMATIC STOP FOR AUTOMOBILES; Charles O. Lambert, Bridgeport, Conn. App. filed Feb. 27, 1900. An attachment for automobiles including a lever arrangement beneath the driver's seat whereby the car is automatically stopped when the driver leaves his seat. Adapted to stop the car in emergencies.

855,723. ELECTRIC REGULATING DEVICE; Leon J. Le Pontois, New Rochelle, N. Y. App. filed Dec. 11, 1905. Small generator for ignition apparatus.

855,723. ELECTRIC REGULATING DEVICE; James F. McElroy, Albany, N. Y. App. filed July 10, 1905. A regulating device for a dynamo including a motor and contacts in the motor circuit adapted to be closed by a magnet, set to act at a voltage greater than that required by the motor when exerting the maximum torque imposed by the devices which it operates.

855,727. ELECTRIC SIGNALLING SYSTEM; Edward L. Orcutt and Richard Sheldon, New York, N. Y. App. filed Sept. 1, 1906. A signalling circuit is provided on the train and adapted to be governed by a controller which controller is operated by the track rail circuit.

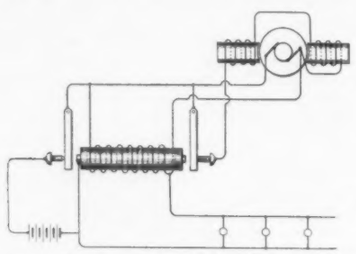
855,729. ELECTRIC BELL; Marcus Plato, London, England. App. filed Oct. 6, 1904. A device for ringing large electric bells or gongs. The usual vibrator armature has a large hammer or clapper and a counterbalancing weight so as to facilitate its movement.

855,738. ELECTRODE FOR ARC LAMPS; Samuel T. Wilbur, Wilkinsburg, Pa. App. filed Dec. 6, 1902. An arc-lamp electrode composed of carbon mixed with materials which form a slag during tthe operation of the lamp, in combination with a conducting projection forming an integral part of the said electrode and composed of material free from such slag-producing materials.

855,801. GAS VALVE; Daniel M. Moore, Newark, N. J. App. filed Apr. 16, 1906. The combination of a mass of porous material interposed in a gas passage, a sealing liquid and means for carying the exposure of the mass above said liquid to regulate the flow of gas.

855,805. GOVERNOR FOR ELECTRIC MOTORS; Alphonse F. Pieper, Rochester, N. Y. App filed Sept. 16, 1904. Provides a governor for electric motors whereby the speed of the armature or rotary operating part is automatically regulated by controlling the flow of the operating current. The governor is directly mounted on the armature shaft.

855,880. BATTERY; Bertram B. Downs, St. Paul, Minn. App. filed Apr. 2, 1906. Relates to improvements in dry batteries. The batteries



855,450—Potential Regulator.

are hermetically sealed up in pitch in a rectangular box so as to prevent evaporation of the water therefrom.

855,895. METHOD OF SEPARATING MINERALS; A. F. Kirschner, Pittsburg, Pa. App. filed Jan. 17, 1907. The herein described method of separating minerals from their ores, which consists in suspending the ore within an air-tight space charged with a gaseous medium having lower permeability than atmospheric air, and subjecting the ore while in suspension within said charged space to electro-magnetic action.

855,897. CONTROLLER FOR ELECTRIC MOTORS AND SIMILAR DEVICES; Harry W. Leonard, Bronxville, N. Y. App. filed July 11, 1903. A combined controller and circuit breaker.

855,911. TELEPHONE-RECEIVER; Kelly M. Turner, New York. App. filed Feb. 5, 1907. A telephone receiver having two bobbins each sectionally wound with corresponding leads extending from the respective bobbins, a circuit controller having two rows of contacts respectively connected with said leads, a pair of spring blades adapted to make contact simultaneously with a pair of corresponding contacts of the respective rows, and means projecting through the casing of the receiver for angularly moving said blades to make connection with different pairs of contacts, whereby the number of turns in the telephone circuit of the two bobbins is simultaneously varied and the sensitiveness of the receiver varied.

855,924. FASTENER FOR PIPE AND CONDUIT SUPPORTS; Robert W. Beaton, Chicago, Ill. App. filed June 30, 1906. A metallic bar is perforated with holes and openings so that it may be secured upon the beams or rafters of a dwelling and support the outlet box of the electric lighting circuits thereof.

855,936. SAFETY DEVICE FOR GAS BURNERS; Arthur A. Churchill, Portland, Ore. App. filed July 18, 1906. An electrical device including a thermostat suspended above the gas flame whereby circuits are controlled to turn off the gas in case the flame is extinguished.

855,952. APPARATUS FOR FEEDING CABLES INTO CONDUITS; Edward J. Hutchins, New Haven, Conn. App. filed Aug. 3, 1906. A mechanism adapted to guide telephone cables into the usual conduit therefor. Has reels on a small truck and driven by a gasoline engine.

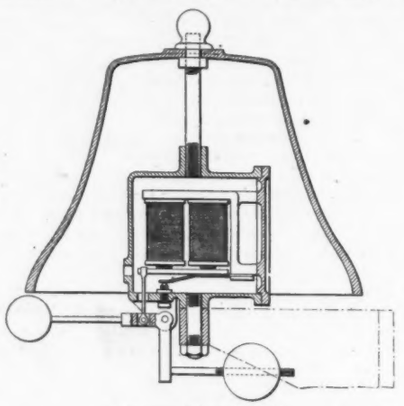
855,968. ELECTRIC SIGNALLING DEVICE; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. An electric train stop device having circuits including only the usual track rails by which the alarm circuits, etc., are operated in the engine cab.

855,967. ELECTRIC SIGNALLING DEVICE; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Relates to modifications of the above.

855,968. ELECTRIC SIGNALLING DEVICE; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Covers additional modifications.

855,971. RAILWAY SIGNAL; Charles C. Phillips, Owensboro, Ky. App. filed Aug. 6, 1906. A sector-shaped semaphore arm swings in a circular casing under the influence of separate operating and locking magnets.

855,972. CONTROLLER FOR ELECTRIC MOTORS; William D. Pomeroy, Norwood, O. App. filed Dec. 1, 1903. Relates to controllers



855,729—Electric Bell.

for electric motors and more particularly to controllers adapted to change the speed of a motor by changing the voltage applied thereto, and operated by a multiple voltage system.

855,973. MECHANICAL MOVEMENT; Joseph Y. Porter, Detroit, Mich. App. filed May 21, 1906. A device for use with track switches by which successive operations of a solenoid produce alternate movements of an actuated part. Has a ball movable in a tilting tube.

855,985. CONDUIT; George Russell, McKeesport, Pa. App. filed Aug. 22, 1906. A substitute for the usual process of sand blasting and pickling the interior of pipe conduits to make them smooth. The conduit pipe is formed with an interior sheet metal lining.

856,085. ELECTRICAL CUT-OUT; Philip T. McNally, Mandan, N. D. App. filed May 25, 1906. An ordinary snap switch has a shaft extension with a gear which is engaged by a solenoid operated rack, so that the snap switch may be operated from a distant point.

856,094. ELECTRICAL SIGNALING DEVICE FOR RAILROADS; Edward L. Orcutt, New York, N. Y. App. filed Oct. 13, 1905. Relates to railroad signals and type having track rails energized by an alternating current and means for displaying signals in the locomotive cab.

856,095. ELECTRIC SEMAPHORE; Edward L. Orcutt, New York, N. Y. App. filed Sept. 1, 1906. Relates to features of the semaphore construction for the above.

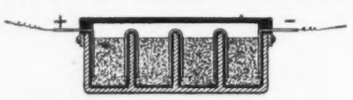
856,099. CABLE HANGER; Charles L. Peirce, Jr., Chicago, Ill. App. filed Sept. 13, 1906. A sheet metal strap is perforated so that one end may be inserted through a loop in the other end and engaged upon the cable to be suspended. The ends of this strap engage hooks on a hanger depending from the messenger wire.

856,127. RAIL BOND; James J. Brennan, Fort Wayne, Ind. App. filed Sept. 24, 1906. Aims to provide a rail bond so mounted upon the rails as to be easily installed, inspected, repaired or detached without destroying the connection with the rail. The usual rift pin is driven into place when the usual plugs are hammered into their sockets in the rail. The soldered connections of the pin may be repaired without interference with the plug connection.

856,132. ELECTRIC BURGLAR ALARM; Bert J. Cizkovsky, Chicago, Ill. App. filed Aug. 22, 1906. Relates to an electric burglar alarm which may be placed in position upon a door or window wherever desired. Is in the form of a hinge having projecting arms which close the circuit when displaced with respect to one another.

856,146. LOCK-OUT DEVICE FOR TELEPHONES; R. C. M. Hastings, et al., Athens, Ohio. App. filed May 7, 1906. Relates to local set of party line system.

856,149. AERIAL RADIATING CIRCUIT; Peter C. Hewitt, New York, N. Y. App. filed Mar. 7, 1904. A radiator for electromagnetic



856,162—Fire-Alarm Circuit.

waves consisting of a step-up auto converter, in combination with means for energizing the same.

856,150. METHOD OF RADIATING ELECTROMAGNETIC WAVES; Peter C. Hewitt, New York, N. Y. App. filed Jan. 20, 1904. Renewed Feb. 21, 1907. The method of radiating energy by means of electromagnetic waves, which method consists in generating by separate circuits, a series of magnet fluxes, in the same direction, along a common axis forming one field.

856,162. FIRE-ALARM CIRCUIT; Isidor Kitsee, Philadelphia, Pa. App. filed Oct. 31, 1902. A fire alarm indicator including a plurality of cells which generate an electromotive force when they are heated.

856,163. ELECTRIC RELAY; Isidor Kitsee, Philadelphia, Pa. App. filed June 8, 1905. A form of relay having a siphon recorder for submarine telegraphy.

856,165. FLOOR BOX FOR ELECTRIC WIRING; Hubert Krantz, New York, N. Y. App. filed Sept. 22, 1905. An outlet box adapted to be inset in a floor by which the floor may be finished without first positioning the box.

856,179. ELECTRIC SIGNAL; Robert Pfeil, Grunewald, Berlin, Germany. App. filed Jan. 19, 1906. Has a motor operated signal and manually operated means for controlling the setting of the signal and means dependent upon the condition to be indicated by the signal for causing the motor to return the signal to corresponding position.